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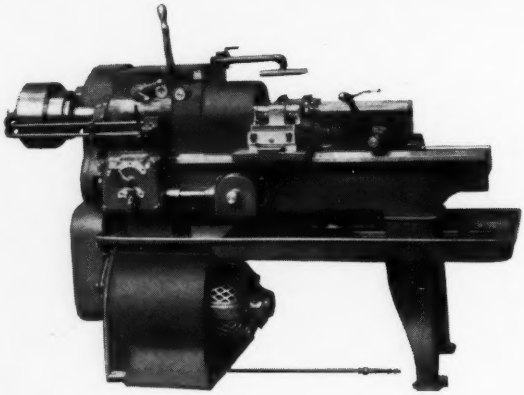

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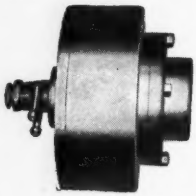

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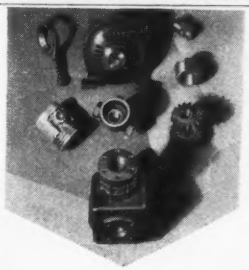

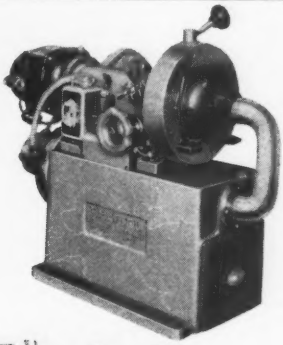

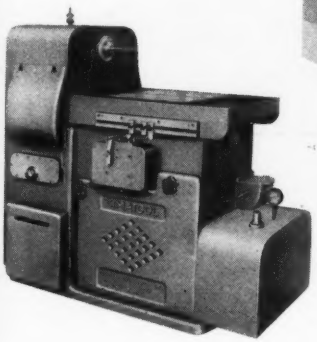

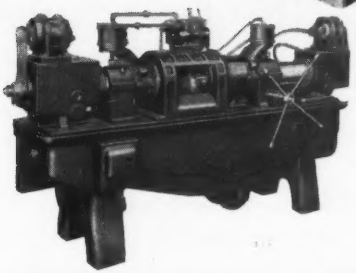

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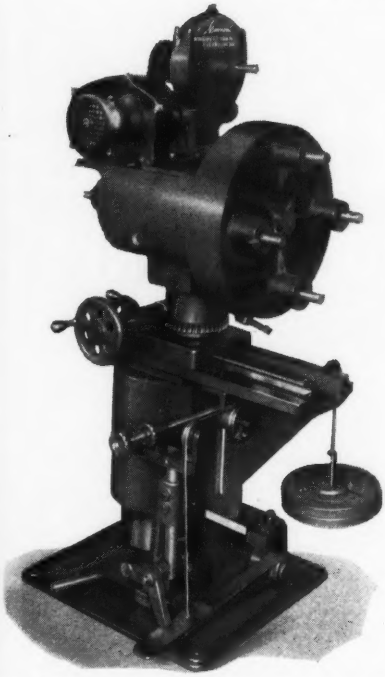

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Volume 5 MARCH, 1933 Number 10

A Magazine for Machine Shop Executives

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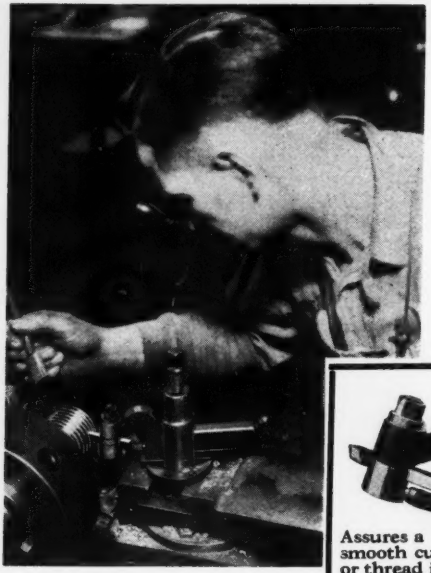

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MODERN Machine Shop

MARCH, 1933

CINCINNATI, OHIO VOL. 5, NO. 10

Precision Grinding Methods at the Addressograph Plant

Special fixtures aid in obtaining accuracy on fine work

By FRED B. JACOBS

OCCUPYING a floor space of approximately 307,200 square feet, the new plant of the Addressograph-Multigraph Corporation, Cleveland, Ohio, comprises one of the most modern machine shops in this country. The company's product is manufactured in quantities, yet every part is held to close limits of accuracy; it naturally follows, therefore, that precision grinding is an important part of the manufacturing process. In this article the author will describe briefly some of the more interesting of the precision grinding operations referred to.

Figure 1 illustrates an unusual operation — the grinding of a metal-backed rubber blanket for a multigraphing machine. The blanket is 12 in. wide and 14 in. long, and is finish ground to a thickness of 0.065 in. It is held and rotated by means of a special drum-type fixture, over which it is stretched as shown. Each end of the blanket is provided with a series of slots, the rubber stopping just short of the slots. The blanket is hooked, by means of the slots, over special clamps which are then tightened so

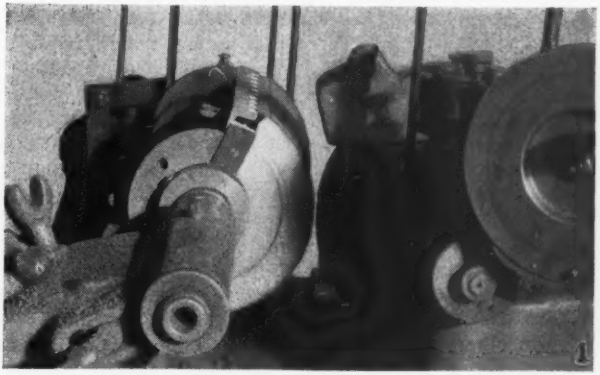
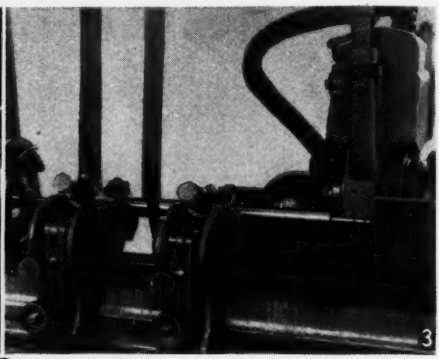


Fig. 1—Grinding the surface of a rubber blanket for use on a multigraphing machine.



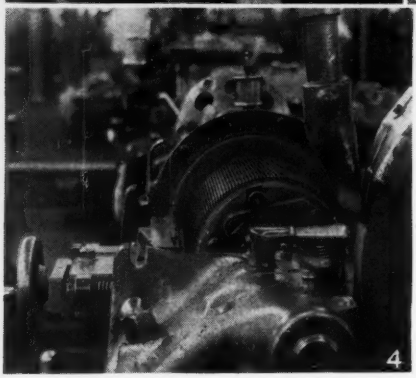


Fig. 2—Rubber feed rolls are ground to size and finish in this machine. Fig. 3—Grinding step bearings on the end of an ink fountain roll. Fig. 4—Segment for a multigraphing machine in position for grinding. After the grinding operation has been performed, the block carrying the set of scoring tools — shown at the front of the machine — is fed forward and the segment is grooved.

as to stretch the blanket tightly around the fixture.

The machine in which this operation is performed is a No. 1½ Landis, fitted with a 24 grit, K grade Alundum wheel 12 in. in diameter and with a 1-in. face and 5-in. arbor hole. The wheel revolves at a speed of 1,900 r.p.m., while the work speed is 60 r.p.m.

Rubber is not generally considered an ideal material for finishing by the grinding method, but the operation under discussion is productive of excellent results. The rubber is, of course, ground dry. The radius of the ground portion is 4 in., and the work feed about ⅛ in. at each revolution. Several cuts are taken, removing a total of perhaps 0.040 in. The fixture itself having been finished by grinding, it follows that the work will also be uniform and accurate as care is taken to locate it properly on the fixture. While this operation is still in the experimental stage, the results thus far more than meet expectations.

The grinding of another rubber-covered piece upon which a high degree of accuracy is essential is illustrated in Figure 2. The part in process is a rubber feed roll 1 in. in diameter and 13 17/32 in. long. The rubber is moulded around a steel shaft, which is centered so that it can be swung between centers, and the object of the grinding operation is to make the outer surface of the rubber concentric with the centers and bearings of the shaft.

The operation is performed in a Webster & Perks No. 2 grinder which is fitted with a 12 x ½-in., 60 grit, L grade, Alundum wheel. The spindle speed is 2,200 r.p.m., and the work speed is 300 r.p.m. The work is

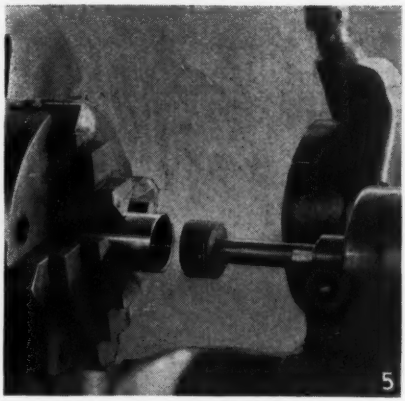


Fig. 5—Bushings are made from tubing, the pieces being ground to size after cutting to length.

ground dry. By grinding these rubber rolls, a finish and degree of accuracy is obtained which would be difficult to obtain in any other manner.

The piece shown in the grinder in Fig. 3 is an ink fountain roll, the body of which is 18 in. long and 1¼ in. in diameter. At each end of the body is a bearing with two steps, one of which is 0.4375 in. in diameter and 1¼ in. long, and the other 0.375 in. in diameter by 1 in. long. In making these rolls, the stock was first cut to length and then the pieces were passed through a centerless grinder in which the rolls were ground to within 0.002—0.004 in. of the finish size. The rolls are then sent to a screw machine where the end bearings are centered and turned, after which they are brought to the grinding department for the finishing operation. A dog is used to drive the piece in the usual manner, and two back rests are employed to overcome any possible tendency to chatter which might result due to the comparatively slender sections at each end of the roll. An Alundum 18 x 2-in., 46 grit, N grade wheel is used for this operation, operating at a spindle speed of 1,800 r.p.m. The work speed is 228 r.p.m.

The illustration Fig. 4 shows a segment for a multigraph machine in position for grinding the periphery. The appearance of serrations on the surface is due to the construction, drawn steel I-section bars being caulked into milled slots in the body of the segment, which is of aluminum alloy. The segment is 7.81 in. in diameter and 8½ in. long, the short length making it possible to mount two segments for simultaneous grinding. The work is driven by means of latch levers on each end of the fixture, with holes through which pins are inserted into corresponding holes in the segments. Springs on the levers

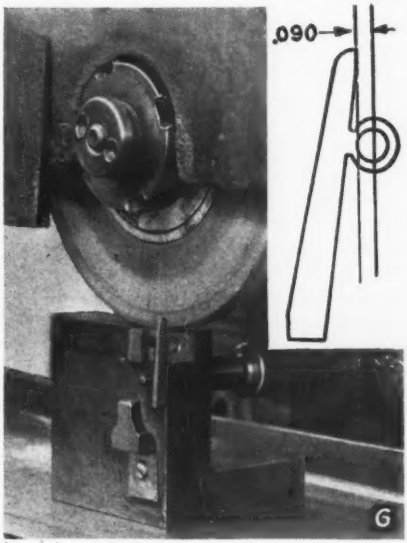


Fig. 6—Grinding an angle on the side of a frame driving pawl.

exert sufficient pressure to hold the segments in place.

For this operation a 12 x 36-in. Landis grinder is used, fitted with an

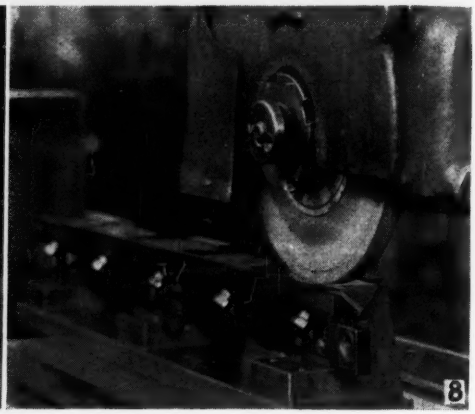


Fig. 7—Surface-grinding pressure blocks to size. Fig. 8—Grinding bevels on the blade of a knife for a paper cutter.

18 x 2-in. Alundum wheel combination grit K grade. The wheel runs at 1,780 r.p.m., while the speed of the work is 76 r.p.m. The segments are ground to close limits of accuracy, thus assuring that the assembled multigraph machine will turn out printed work in which every type-impression is alike.

Referring again to Fig. 4, an additional fixture is shown at the front of the machine, carrying a set of scoring tools that are aligned parallel to the work. After the segment has been ground, the block carrying the scoring tools is fed forward, by means of the hand wheel, and light scores or grooves are cut at even intervals in the ground surface. These grooves serve as guides for the multigraph machine operator in setting the lines of type. By combining the scoring operation with the finish grinding operation, an extra set-up for scoring is eliminated.

Of the internal grinding operations necessary to the production of multigraph machine parts, the one shown in Fig. 5 is typical. The piece is a bushing, 2 in. long and 1.125 in. inside diameter, made from steel tubing. The object of the grinding operation is to obtain a better surface than that produced by the drawing dies in which the tubing was formed. After the hole is finished, the bushing is placed on an arbor and the outside diameter is ground in the usual manner. All things considered, it is cheaper to make these bushings from tubing and grind them than it is to form them from bar stock in the screw machine.

A simple surface grinding operation in which an interesting fixture is used is illustrated in Fig. 6. Here a surface grinding machine is being used to grind a flat surface on the side of a case-hardened frame driving pawl, the pawl being designed with a lug in which a hole is drilled, the center of which must be 0.090 in. from the plane of the flat surface. The dimension is shown in the drawing at the right in the illustration. The hole is drilled first, then the flat surface is ground by holding the piece in a fixture on the table of the grinding machine and grinding with the side of the wheel, as shown.

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The fixture is made with a horizontal tapered hole opening at the side, into which the lug on the pawl can be slipped. As the lug is pushed toward the closed end of the hole, it binds in the tapered slot and the pawl is held firmly in a vertical position. To insure that the piece will be held at the correct angle so that the 90-degree dimension will be accurate, a stop is provided against which the lower end of the piece is held by means of a spring plunger. The stop and spring plunger can be seen in the illustration, but the pawl is shown at the edge of the hole so that the lug can be seen. The piece is ground dry, as the small amount of heat generated is largely absorbed by the fixture.

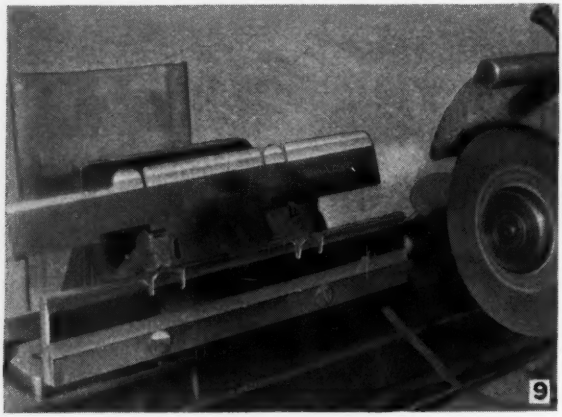


Fig. 9—Set-up for grinding a double bevel on a safety plate. A finished piece is shown on the top of the fixture.

Among the parts that enter into the construction of addressograph and multigraph machines are a number of case-hardened steel pressure blocks which, in order to insure the necessary close limits of accuracy, are surface ground. Figure 7 shows six of these blocks, each 4½ in. long, 1½ in. wide, and 0.375 in. thick, in position for grinding in an abrasive surface grinding machine. A 46 grit, G grade Alundum cup wheel of 5 in. diameter and with 1 in. wall is used, operating at a speed of 2,400 r.p.m.

In Fig. 8 is shown an interesting fixture that is used for grinding the cutting edges of paper knife blades. The blade is clamped to a work-holding fixture which, in turn, is placed in a locating fixture that is held by the magnetic chuck of the grinder. As the cutting edge is ground to an included angle of 90 degrees, the design of the fixture is such that, after one bevel has been ground, the work-holder can be reversed and at the same time turned over so as to bring the other bevel to the correct working position. The knife shown in position in the illustration is 21½ in. long and ¾ in. wide. It is 0.125 in. thick at the bevel, but tapers to 0.090 in. toward the heel. This operation is performed wet and an automatic feed is used.

The operation illustrated in Fig. 9 is that of grinding a double bevel on a safety plate that is 11 1/6 in. long, 2 7/16 in. wide, and 0.005 in. thick at the edge. One of the safety plates is shown in position in the fixture, with a finished piece standing on the fixture, so that the finished double bevel can be seen. The usual practice is to grind one radius on perhaps 100 pieces, then set the machine for the second radius and finish the lot. The work locates directly on a special fixture which, in turn, is held by a magnetic chuck. This operation is exacting as the wheel must be of the

exact size to produce the required radius, and the parts must be positioned accurately when the set-up for each cut is made. A 46 grit, H grade wheel is used, operating at a speed of 2,200 r.p.m. As the upper bevel runs out at 0.005 in., care must be exercised to make sure that the wheel is free-cutting at all times.

The foregoing descriptions of grinding operations at the Addressograph-Multigraph plant illustrate graphically the manner in which skill and ingenuity are combined in the production of this company's product.

Oil Tanker of All-Welded Steel Construction

An English ship-building firm is now building, for a Canadian customer, an oil tank barge the construction of which may mark the beginning of a new era in shipbuilding practice. The tanker will be built of steel—which is common practice—but there will be hardly a rivet, a caulked seam, or a punched hole in the entire vessel. The frame-work will be built up by welding, and the steel plate which forms the shell will be welded to the frame.

Alloy 548, Developed By Carboloy, to be Commercially Released in Near Future

Alloy 548—a new alloy with a field of application between high speed steels and cemented carbides—was announced at a recent Cleveland meeting of the American Society for Steel Treating by Dr. Jeffries, president of Carboloy Company, Inc., Detroit, Michigan. Laboratory tests and preliminary tests in production, stated Dr. Jeffries, show that Alloy 548 has qualities midway between high speed steel and cemented carbide—a field where a gap still exists, according to tool experts. Tests to date so far indicate that Alloy 548 will cut not only those materials which high speed steel ordinarily cuts, but that it produces a higher order of results on the easier jobs, such as soft steel and cast iron, and a satisfactory improvement in results on the harder steels.

The composition of Alloy 548 is principally a combination of iron, tungsten and cobalt. However, among the characteristics which differ from other alloys having these basic metals is the fact that Alloy 548 functions best when carbon-free, or with very little carbon. Similar to high speed steels, it can be melted, cast, forged, or rolled, then machined and heat treated for use. Its moderate price range permits it to be made into solid tools or cutters, although inserts may prove economical on many applications.

Carboloy Company, Inc., states that the announcement made before the Society by Dr. Jeffries was intended as a general statement of the present status of development and application from the standpoint of metallurgical interest, rather than as a formal, commercial release. Although Alloy 548 gives every indication of being satisfactory in the above defined field, the manufacturer plans to follow a reasonably conservative policy in releasing the material, by selecting representative applications in various industries and closely following those applications during the initial period of commercial development. In adopting this policy, Carboloy Company, Inc., hopes to avoid the "stunt" performances and unsuitable applications which so retarded the progress of cemented carbide during its period of early use, to the detriment of all concerned. It is felt that Alloy 548 will thus more speedily reach a normally developed stage of most economical, standardized application in the field for which it is best suited.

Westinghouse Flexarc Welders. A publication describing the new 300 ampere Flex-Arc Welders, its applications and distinctive features has recently been issued by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. These welders are designed especially to handle a current range from 90 to 375 amperes and are available with a. c. or d. c. drives. They are equipped with the Westinghouse nonsurge welding circuit for use with bare or coated electrodes.

Copies of the publication may be obtained from the nearest district office or direct from the Advertising Department of the above-named company.

Cadmium as a Corrosion Preventive

By GUSTAF SODERBERG
Technical Director, Udylite Process Co., Detroit, Michigan.

RUST is a tenacious enemy of ferrite and a constant menace to every article that is made of iron or steel, excepting, of course, the high chromium alloy steels. The national junk pile is in itself sufficient evidence of the crying need for efficient protection against this insidious destroyer of useful products. Attempts have been made in past years to guard against this waste by the use of methods that have been largely elementary and unsatisfactory, and not until quite recently has the problem been solved in a thoroughly practical and satisfactory manner.

The development of a method whereby cadmium can be applied as a surface coating has provided an effective protection against the ravages of rust. At the present time, protective coatings of cadmium are being applied to so many metal products that it is impossible to name all of them. However, among the products to which cadmium is being successfully applied are nuts, bolts, washers, wire products, springs, metal stampings of all kinds, screw machine products, forgings, automobile parts, air conditioning units and parts, aircraft parts, radio parts, washing machine and washing machine parts, electric refrigerators and parts, office equipment, interior hardware of all descriptions, marine hardware and fittings, electrical products, such as contacts, switches, conduit, appliances, switch boxes, and so on, concrete reinforcing bars, brick, stone, and terra cotta anchors, and structural sections to be immersed in concrete.

Method of Application

Cadmium is applied to metal objects by electrodeposition; thus it is applied in fundamentally the same manner as copper, nickel, chromium, or

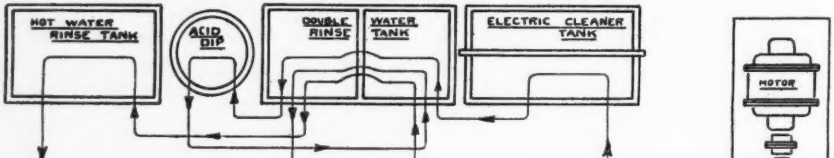
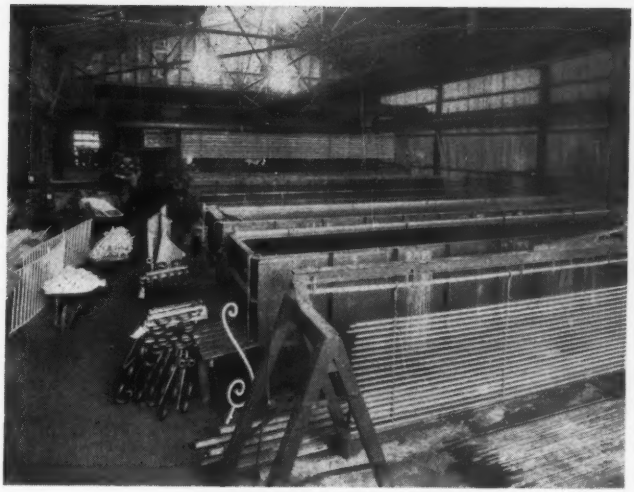


Diagram showing layout of equipment for small cadmium-plating installation. Arrows indicate flow of work through consecutive operations.



View of cadmium plating equipment used for plating reinforcing bars.

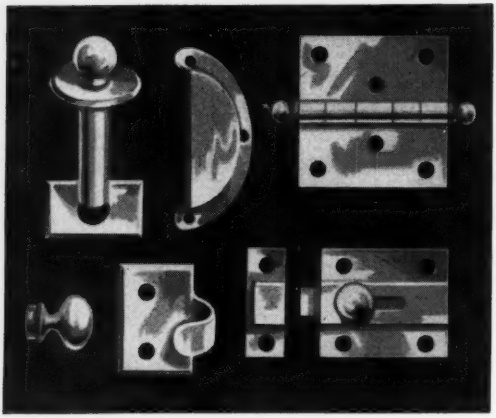
any other metal that is used in electroplating. Cadmium plating varies, however, in that the control of the solution can be accomplished simply and easily. The solution does not require heat; i. e., it is operated at room temperature. No toxic fumes are produced. An important advantage in the use of cadmium consists in that the solution possesses the ability to deposit metal into deep recesses and crevices.

The first step in the procedure of applying cadmium plate is to clean the work-pieces so that they are entirely free from oil and grease. Neither cadmium nor any other metal can successfully be deposited on a dirty surface. After the parts have been thoroughly cleaned, they are rinsed in water and are then immersed in a suitable acid pickle. The pickling procedure removes all rust and scale, exposing a chemically clean surface.

The next step is a rinse in cold water, followed by immersion in the cadmium plating bath. Here the parts are made the cathode in an electrical circuit, attracting a negative charge of electricity. The anodes likewise attract a positive charge. Thus the cadmium in the bath is charged positively and the cyanide radicals are charged negatively. Elementary physics tells us that opposite poles attract each other, therefore the work-pieces, which are charged negatively, attract the cadmium which is charged positively, resulting in a formation of an electrodeposit of cadmium on the work. The negatively charged cyanide attacks the positively charged anodes and passes the cadmium into solution.

The work is immersed for approximately ten minutes, after which it is taken from the bath and rinsed, first in a double rinse of clean, cold water and then in hot water. The object of the final hot rinse is to completely remove absorbed chemicals and to aid in drying the parts more quickly.

From beginning to end and including all operations, the cadmium plating cycle usually takes no longer than twenty minutes. Aside from the preliminary cleaning operations, the



Assortment of hardware parts finished with cadmium.

parts are not given any extra treatment, such as polishing. It is not necessary that cadmium deposits be buffed to bring up the lustre after plating, although in some cases manufacturers ball-burnish the parts to enrich the appearance.

Properties of Cadmium

Cadmium possesses a number of properties—peculiar to it alone—which make it extremely desirable as a protective finishing material. Discussion of these properties will be sufficient explanation of its broad usage.

First of all, a coating of cadmium serves as a highly effective protection against rust. The primary reason why properly-deposited cadmium coatings are so efficient is that they are resistant to atmospheric influences and that they are anodic to iron. Without entering into more technical phases of electrochemical discussion, the latter statement merely means that the cadmium coating would have to be corroded away before the iron could be attacked. Consequently, even though the cadmium coating might be damaged through mishandling, protection against rust would continue.

A simple test illustrates this electrolytic protection very nicely. A solid plug of cadmium was inserted into the hole in an uncovered steel washer and the washer was placed in a salt solution. When removed, some time later, the steel showed no rust, but the cadmium had been attacked slightly. When immersed in the same solution without the cadmium, the washer rusted very quickly.

Uniformity of thickness is an additional property that is of vital importance. The old saying, "A chain is as strong as its weakest link," applies aptly to corrosion-preventive coatings in that the protective action lasts as long as the thinnest portion of the coating. The covering, in order to be really efficient, should be of uniform thickness. The properly-compounded cadmium plating solution possesses a remarkably high "throwing power," or ability to uniformly coat recessed parts — parts that ordinary metals do not reach. Thus the danger of too much metal being deposited in one spot and too little in another is eliminated, and the uniform protection which results from uniform coverage is obtained.

The second important property is that of appearance. Cadmium coatings, when applied in correctly-formulated baths, possess a silvery-white lustre that is very attractive, making cadmium plate desirable not only as a rust preventive, but also as a finish. Many manufacturers have found the combination of these two properties of great advantage as a sales aid.

Cadmium resists the action of saline atmosphere and alkaline corrosive media to a remarkable degree, making it particularly useful as a protection for such parts as marine hardware and washing machine parts. The contact resistance of cadmium is very low. As a matter of fact, it offers less resistance to electrical current than copper, for which reason it is used extensively in the electrical manufacturing industries. Cadmium coatings solder easily and well. They also possess the property of ductility, which property has enabled manufacturers to plate flat pieces and then stamp or form the pieces to the desired shapes.

Cost of Cadmium Plating

The cost of cadmium coating is low, comparatively, for which reason many manufacturers have adopted this process. Although a pound of cadmium costs fifty-five cents, but very little is needed to provide a coating of the necessary thickness for efficient protection. For example, more than 100 square feet of surface area can be effectively protected against rust with one pound of cadmium. Thus the greater coverage obtained more than counterbalances the relatively high metal cost and brings cadmium within the reach of the manufacturer whose objective is the production of an attractive, rust-proof article at the lowest possible cost.

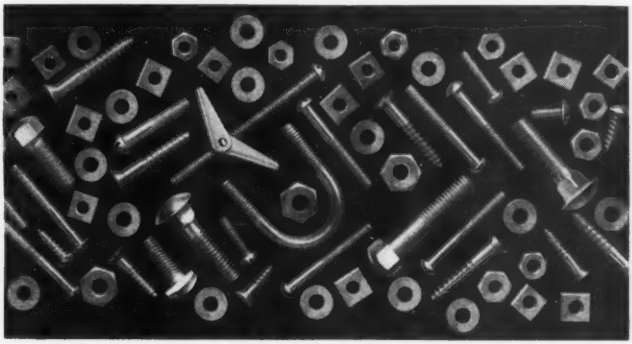
In considering the matter of costs, consideration must be given to the following important electrochemical principles, i. e., high electrochemical equivalent, high cathode efficiency, and high throwing power. An article in process of plating in a solution having these advantages receives a thicker electrodeposit, and in much less time, than in a bath that is without these qualities. The cadmium plating cycle is short and more loads are possible per day, with lower costs per unit.

Finally, the cost of cadmium-plating equipment is low in comparison to that required for some rust-proofing processes. This feature, in addition to the above, tends to bring cadmium plating costs down.

Typical Uses of Cadmium

Firms that make tools such as wrenches, screw drivers, jacks, and similar products, find that cadmium is admirably suited to their needs. The coatings provide efficient rust protection, do not crack or mar easily, and serve to "dress up" their products and thus make them more attractive, which, in turn, increases sales.

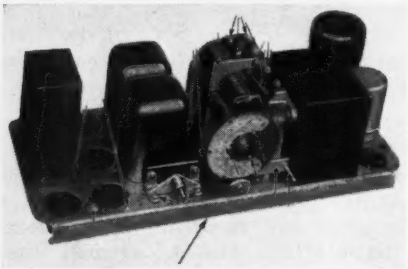
It has already been recorded that cadmium has the property of immunity to alkaline solutions—a property that is of vital interest to the building industries. Cement and concrete



Assortment of bolts, nuts, and other small parts that have been plated with cadmium.

are porous and are alkaline. Bare steel reinforcing bars and structural sections that are exposed to moisture seeping through the concrete quickly disintegrate, with the result that the concrete cracks. Most rust protective coatings are quickly dissolved by alkalies, rendering them useless to prevent this type of corrosion. By plating the parts and sections with cadmium, cracking due to these causes has been overcome.

Attractiveness of appearance is one property that has been utilized



Chassis of a well-known make of radio. The arrows indicate parts that have been plated with cadmium for protection against rust.

extensively by the lighting fixture manufacturers. Such products must be attractively finished if they are to sell quickly. In a number of instances, fixtures made of bronze were cadmium-plated for the sake of the finish alone. The radio and refrigerator industries are large users of cadmium. Cadmium was chosen for its protective properties, economy, uniform coverage in recessed parts, and the ease with which cadmium-coated surfaces can be soldered.

Protection of the highest degree of efficiency must be given to aircraft parts, for which reason cadmium is specified by the United States army and navy. Cadmium occupies a prominent place in the finishing of hardware, due to the qualities of rust protection, appearance, and economy.

Manufacturers of screw machine products, nuts, bolts, and so on, have a very practical reason for the use of cadmium, in addition to the reasons enumerated above. The cadmium, while providing a thoroughly efficient coating, is applied as thin as 0.0002 in. thick, which means that threaded parts need not be machined undersize to allow for the application of cadmium afterward.

As indicated above, cadmium has furnished the solution to thousands of difficult problems, and the field of possibilities has hardly been scratched as yet.

Monarch Centrode Device. This 24-page 8½ x 11-in. catalog is devoted to an exposition of the advantages and possibilities of the Monarch Centrode Device and its companion piece, the Monarch Oval Chuck. In addition to descriptions of these comparatively recent developments, the book contains the formulae for figuring the correct stroke setting of the Centrode Device and correct set-over for the Oval Chuck. By means of a set of drawings, practically every design or contour that might be encountered is illustrated, with the formulae for setting up the machine to obtain the design desired.

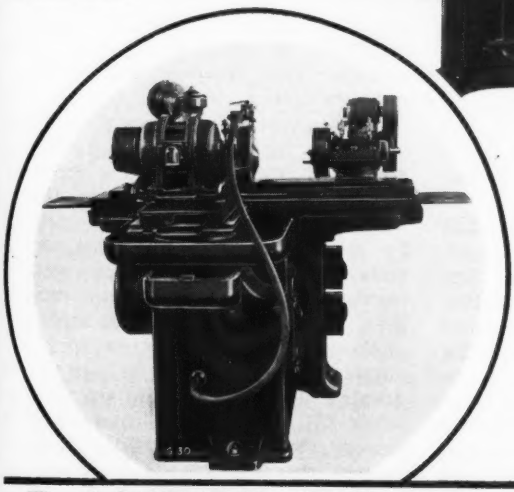
The book also contains photographs of a variety of jobs that have been produced by the use of this equipment, together with descriptions and detailed information regarding the manner in which the various jobs were produced and the results that were obtained. Copies free to mechanical executives.

P & W No. 2A Universal Die Sinker. This four-page, 8½ x 11-in. bulletin gives full specifications for the Pratt & Whitney No. 2A Universal Die Sinker and illustrates, by means of photographs, the type of work for which the machine is particularly adapted. A number of pictures of drop forging dies are included, with descriptions and information as to time required, accuracy, and so on. Copies gratis.

A New LANDIS

The 10" x 24" MOTOR DRIVEN UNIVERSAL

In this new Landis 10" x24" Motor Driven Universal industry will find a machine for which there is a decided need. Whatever the point of view---economy in operation, work output of high quality, ease of operation, pleasing and clear-cut appearance, complete motorization --- this thoroughly modern grinder deserves your consideration.



Many plants of all sizes will find the 10" x 24" Motor Driven Universal of great value for the grinding of a huge variety of small parts which are manufactured in small lots. Being a Universal it may also be used for practically any kind of tool room work. Technical colleges and schools in need of a grinding machine will do well to investigate its possibilities. A descriptive circular is now ready for mailing. Shall we send it?

LANDIS TOOL COMPANY
WAYNESBORO PENNSYLVANIA
DETROIT CHICAGO NEWARK PHILADELPHIA
116

Drop Forging Die Design

By
FRANK C. WALDO

This article contains some useful information for tool designers who may be called upon to lay out a set of dies for drop forgings.

DROP-FORGING dies consist of two steel blocks, each of which contains an impression of half of the forging to be produced. The upper die section is attached to the ram and the lower section to the sow-block of the anvil. Alignment is obtained by match surfaces machined on corresponding sides of each section, so that the die impressions will match accurately.

In laying out a forging die, the main factors to be considered are the style of the die, the size of the die block in relation to the work, the draft allowances, the shrinkage of the metal being forged, and machining allowances. Other points of importance must be considered, but to a certain extent are governed by the factors listed.

Forging dies are sometimes made with one set of impressions that completes the work in one setting. Another type of die is that consisting of a roughing or forming impression and a finishing impression, requiring the shifting of the work from one side to another. Still another type often used is the multiple impression die which produces several pieces at once. This style is also made in the single- and double-impression type. In all cases, however, the design of the die is determined by the shape and size of the work.

The size of the die and the die-blocks in relation to the work is important. In consequence of the pressure exerted during the squeezing of the metal, it is necessary to have sufficient strength around the impression to avoid the caving-in of the die blocks. It is better to have the die-blocks too large rather than of insufficient size.

The amount of draft, or angle on the impression, depends upon the depth of the forging to be made. The allowances vary from 3 deg., used when a shallow impression is produced, to as high as 15 deg. The average draft, however, is between 7 and 10 degrees.

Certain types of metal require more allowance for shrinkage, and certain forms of forgings require greater shrinkage allowance than others. These points are determined largely by experience. Work having heavy ends and a thin connecting section require greater shrinkage allowances than forgings with uniform sections.

Machining allowances on forgings vary from $\frac{1}{32}$ to $\frac{1}{8}$ in., or even greater, according to the size of the work. It is necessary to allow this amount of metal for finishing in addition to the allowance for shrinkage. Drawings should be furnished to show the exact requirements of the forgings as well as to show the part as finished.

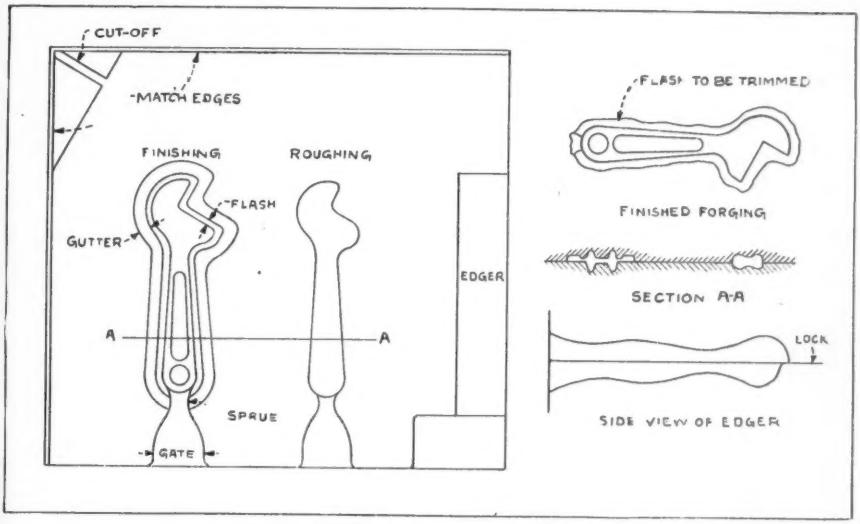
After the size of the block and the

style of the die have been determined, such factors as flash, the gutter, lock, the edger, the gate, the sprue, the fuller, and the cut-off are next in line.

The purpose of the flash is to allow sufficient metal to flow out beyond the impression so that only a thin wall remains, which in turn can be trimmed off easily. The thickness of the flash depends, of course, upon the size of the forging. If desired, the entire flash may be placed in the upper die.

The purpose of the gutter is to take off the overflow from the die in excess of that which lies in the flash. It is necessary always to provide a gutter around the entire edge of the work. If this allowance is not made, there is a likelihood of breakage in the hammer or dies. A gutter may be considered as a factor of safety in drop-forging die design.

The purpose of the edger is to make less work for the dies when the actual striking of the metal in the impression is done. In reality, the edger bends, breaks down, or edges the bar to an approximate shape or outline so that less strain is exerted to the die impression. Edgers are not required on all dies, but in cases where they can be used they should not be overlooked. When an edger is used, the size of die blocks required is somewhat larger.



General layout of a drop forging die.

The sprue should be comparatively small so that it can easily be broken off, whereas the gate is determined by the size of the bar to be forged. Fullers are used when irregular sections or large portions of metal are required in a forging at different points. The purpose of the fuller is to squeeze the metal at desired points, so that it will accordingly fill the impressions when the bar is shifted to the impression. A cutoff is merely a knife-edge placed on some corner of the die so that the finished forging can be trimmed from the bar at the section made by the sprue.

There are several methods by which a forging can be made, and one of them will usually be found more applicable to the individual job than the others. In reaching a decision as to which method should be used, not only the amount of labor involved in making the die should be considered, but also the durability of the die and the number of pieces which it can be expected to produce. A certain amount of variation is to be expected in drop-forging practice, but careful design of dies will minimize this and keep it within reasonable limits.

The information given here is intended for tool designers with limited experience who are called upon from time to time to lay out forging dies, as well as for a general reference for those who are engaged in the manufacture of drop forgings.

Pendulum Measures Hardness of Metals

RESEARCH engineers of the Westinghouse Electric and Manufacturing Company determine the hardness of beryllium by means of a Herbert Pendulum. The pendulum hardness tester is also used with thin sheets of metal, very brittle metals, case-hardened metals or other materials that cannot stand the rigors of hardness testing by the Brinell or scleroscope methods.

This instrument is used to determine the hardness of very brittle metals, thin sheets, or other materials that cannot be tested by means of the usual hardness testing devices.

A tiny spherical steel ball, 1/25 inch in diameter, supports the heavy pendulum upon the test specimen. The spherical ball sinks farther into soft metals than hard metals, lessening the amount of the swing, but increasing the time required for it. An air bubble in the curved tube on top of the pendulum indicates on the scale above the tube the extent of the pendulum's swing, and from this data the specimen's hardness is computed.

"Engineering Week" At Chicago Exposition

The Century of Progress Exposition at Chicago has arranged for an "Engineering Week" to be held during the last week of the month of June, 1933. A Joint Committee of Engineering Societies has been formed in Chicago to stimulate interest in this endeavor and to arrange for the program for a great "Engineers' Day" when the engineer will be not only entertained, but eulogized as well.

Arrangements are being considered to make this occasion of international importance, as many scientists and engineers of world renown will be in Chicago during this time. Other large engineering and power activities for the same week are being arranged. Chicago will be the engineers' capital of the world June 25 to 30, 1933.

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LOSSES AT THEIR SOURCE

If a stick-up man should rob your payroll, you would take steps never to have it happen again. After three or four stick-ups, you would probably build a steel vault around your cashier's cage—shot-gun and machine-gun proof. *You would stop that loss some way.*

There's a thief working in your plant right now. He steals hundreds of thousands of dollars a year—millions throughout industry.

Yet some people do nothing about him.

His name is "Faulty Lubrication." He's a robber net, no discount.

Alemite High Pressure Lubrication Systems PLUS Alemite Industrial Lubricants work year in, year out to EARN profits for you by eliminating 80% or more of repair bills due to faulty lubrication. They earn you more profits through maintenance savings. Write for Alemite's profit story—TODAY!

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Gentlemen:—I am interested in information leading to the reduction of costs through correct lubrication.
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Address .....
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Charging Labor and Material in the Plant

Here is a system by which factory costs and accounts are maintained by one clerk for each 41 men.

By WALDO HUTCHINSON

THAT a knowledge of costs is necessary in order to be able to make an intelligent charge for products or services is a point upon which most manufacturers are agreed, but the methods of computing those costs are as varied as the methods of manufacturing. In some plants that otherwise are modern, the costs either are estimated or the most superficial methods of cost-gathering are used, upon the grounds that the tabulation of costs is too expensive. Such manufacturers will be interested in the factory accounting system described here, which can be maintained by one clerk to each forty-one men. This system is in use in a plant that employs 450 men, and has been in successful operation for several years. The entire job of accounting and gathering all the necessary cost data is handled by eleven men, with what has proved to be unusual freedom from errors.

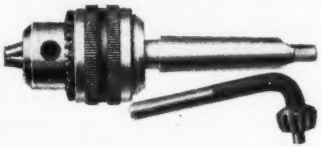
To facilitate the work, the factory accounts have been classified under seven main heads, as indicated in the chart Table I. These seven accounts correspond to the seven principal functions of the plant, and are further divided according to the character of the material, labor, and supplies used in the accomplishment of these functions. Thus the accountant is enabled to analyze and distribute his costs more accurately.

In each department of the factory

Manufacturing Labor	**Producing** **Factory General** **Testing**
Manufacturing Material	**Material** **Foundry Material** **General Supplies**
Maintenance	**Labor** **Material** **% Patterns** **% Tool Stock**
Boxing	**Labor** **Material** **Freight and Cartage**
Add. and Improvements to Plant	**Labor** **Material** **% General Supplies** **% Tool Stock** **% Patterns**
Experimental	**Labor** **Material** **% General Supplies** **% Tool Stock**
Exhibition Work	**Labor** **Material** **% General Supplies** **% Tool Stock**

Table I—Classification of production accounts according to manufacturing functions and material. Labor and supplies are distributed to these accounts.

Almond DRILL CHUCKS:



Gripping power exceeds not only the regular key operated type of chuck, but also the so-called ball bearing drill chuck. Its construction insures long life with practically no cost for maintenance.

THESE ARE THE PRICES YOU SHOULD PAY FOR DRILL CHUCKS: NO HIGHER!

3/16" Capacity	$3.00	1/2" Capacity	$4.50
1/4" Capacity	3.00	5/8" Capacity	4.50
5/16" Capacity	3.50	3/4" Capacity	6.00
3/8" Capacity	3.50	1" Capacity	7.00

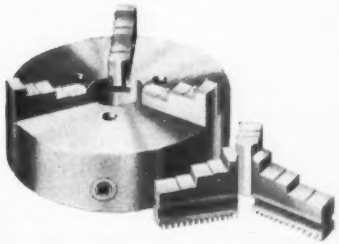
Above Prices do not include Arbors—Ask for New Net Arbor Prices

Almond LATHE CHUCKS

UNIVERSAL GEARED SCROLL:

Chuck bodies of patented one piece construction.
All wearing parts of heat treated alloy steel.

TWO SETS OF JAWS		ONE SET OF JAWS	
Size	Net	Size	Net
3 "	$20.00	3 "	$17.00
4 "	22.00	4 "	19.00
5 "	24.00	5 "	21.00
6 "	28.00	6 "	24.00
7 1/2"	32.00	7 1/2"	27.00
9 "	38.00	9 "	33.00
10 1/2"	44.00	10 1/2"	38.00
12 "	52.00	12 "	45.00
15 "	70.00	15 "	60.00



ALMOND DRILL AND LATHE CHUCKS:

May be obtained from your dealer or ordering direct from the Almond Company, giving your dealer's name.

J. R. Almond Mfg. Co.,
Ashburnham, Mass.

JOB NO. _____ NAME _____

DATE	MATERIAL	DEPT. 1	DEPT. 2	DEPT. 3	DEPT. 4	DEPT. 5	DEPT. 6	DEPT. 7	TOTAL

DATE	ADD. AND IMP. TO PLANT	EXPERIMENTAL	FACTORY GENERAL LABOR	PRODUCTION LABOR	BOXING	SHIPPING	TESTING	MAINTENANCE	SELLING		TOTAL

Form I (Above)—Weekly cost card. The time and material applied to the job by each department is recorded on these cards and the cards are turned in to the office by the department clerks each Monday morning. Form II (Below)—Reverse of the card shown as Form I. On this card are recorded the total charges to the main accounts. The same form is used to record the charges to the main accounts by each department.

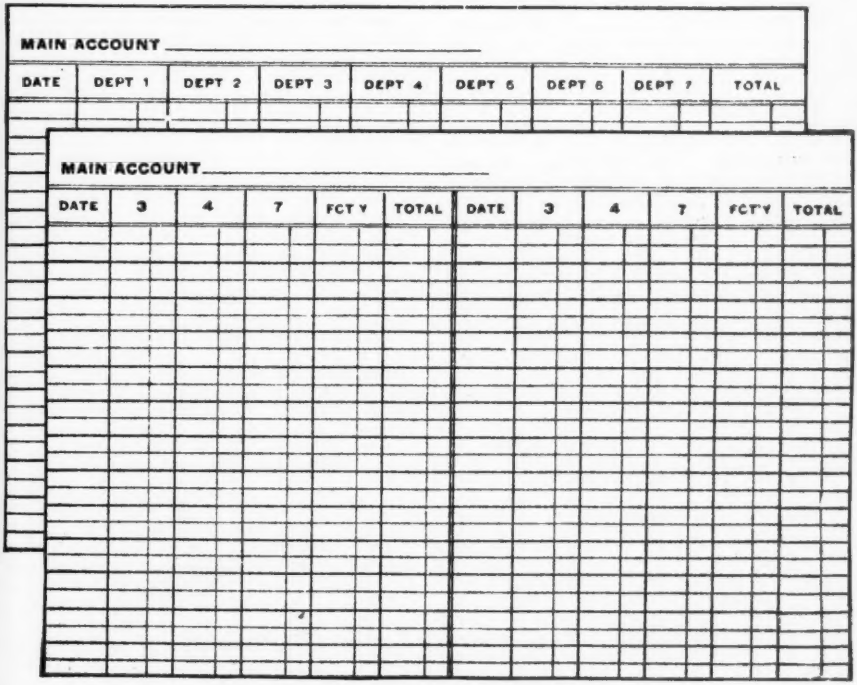
is stationed a clerk who takes care of all the departmental clerical work and, in some cases, also acts as the tool crib man. His chief duty, however, consists in keeping the time cards and maintaining a record of the stock that is issued to other departments from his own department, or of the stock that is received in his department. The stock record is kept in a card index. It can be seen, by reference to Table I, that accounts are divided into such sub-accounts as are found necessary for a thorough comparison of cost figures. All accounts that run throughout the year are given what is termed an "R" number. Special jobs, such as new tools, repairs to tools, and so on, are given special job numbers running in sequence, beginning with number one. All time and material used, no matter what the department, is charged to its respective job number.

The time cards are delivered to the office every Monday morning by the department clerks. There the cards are assorted according to the job numbers and are checked, rated, extended, balanced with the total department payroll, and entered on the card illustrated in Form I.

The clerk who extends these cards furnishes the payroll clerk with a complete list of charges by departments. These charges are distrib-

uted to the accounts to which they belong, and are entered on a card index under the department in which the work was done. On the reverse of each department card is a form for tabulating the main accounts. The sub-accounts are totaled and entered under the main account to which they belong. There is also a total main account card, Form III, showing the amount of work done on these accounts by each department. Another, Form IV, shows the amount of work chargeable to the department bearing the expense.

Raw material is handled through the main stockroom, from which it is distributed upon requisition from the department in which it is to be used. These requisitions are turned in at the office every morning and are immediately distributed to the jobs to which they belong. A strict account of all materials, no matter what they are used for, is kept and a comparison is made at the end of every six months. Scrap, turnings, and filings are charged to the foundry at current prices and are credited to the department in which they originated. A detail account of scrap is also kept by the month, and comparisons are made to afford a basis upon which to check abnormal percentages of scrap or waste in the mechanical departments.



Form III (Above)—This card is the "total main account" card on which is entered the amount of work done on each job by each of the seven departments. In the column at the right is entered the total of the departments. Form IV (Below)—On this card is shown the amount of work chargeable to the department that should share the expense. These four forms accommodate the entire labor and material distribution of the plant.

New Books

FUNDAMENTAL PRINCIPLES OF MACHINE TOOL WORK. By William P. Turner. 424 Pages, 6 x 9 inches, with 543 illustrations. Published by McGraw-Hill Book Company, Inc., New York, N. Y. Price, $3.00.

The author of this volume is Professor of Practical Mechanics at Purdue University, and the book comprises a systematic course of instruction in the fundamental principles of machine tool work. The information contained in this work was originally made available to the students in the form of printed instructions for class-room use, and in publishing the text in this form it is intended that the data and information shall be available not only to students, but also to other individuals who are interested in the basic principles upon which the present highly specialized art of machine tool work is founded.

The first chapter is an outline of shop organization and operation, with instructions in safety, care of machine tools, and so on. Subsequent chapters instruct the reader in the grinding of cutting tools and in applying these tools with the correct speeds and feeds, following through with individual chapters on the operation of the various kinds of machines, the machining of tapers and fits, screw threads, gears, and so on. Hypothetical tasks are set up, with drawings of the parts to be processed and complete instructions for going about the job, including a table of schedule of operations. A series of questions at the end of each chapter make it possible for the reader to check up on his powers of absorption.

Catalog of Westinghouse Industrial Lighting Equipment

A new catalog of industrial lighting equipment has just been announced by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. This publication describes each unit plainly and lists them in a manner easy to find. A complete line of equipment is listed, including new units, low priced industrial floodlights, quick change Wemco reflectors and sockets.

Copies of the catalog may be obtained from the nearest district office or direct from the advertising department at the above address.

Service Caster and Truck Catalog No. 32

In this catalog, containing 48 pages of 8½ x 11 in. size, are illustrated and described each of the various products of the Service Caster and Truck Co., Albion, Michigan. The line includes both casters and trucks, the casters being made for all types of manufacturing portable equipment, with plain, roller, or ball bearings, and in designs that make the casters applicable to equipment of any type of construction. The line includes both casters and trucks, the casters being made for all types of manufacturing portable equipment, with plain, roller, or ball bearings, and in designs that make the casters applicable to equipment of any type of construction. The line of trucks includes dollies of various types, two-wheel hand trucks, platform push trucks, and trailers for all purposes.

Among the hand trucks is one of the ordinary two-wheel design, but equipped with a trailer that rides on a third wheel—or pair of wheels—which can be adjusted to carry the load at the usual angle and thus relieve the operator of the burden of the load while in transit. The platform trucks shown are available with either wood or steel platforms, and with any type of body to suit the job, such as the metal box, removable tray type, compound dump truck, metal scrap truck, cage truck, coal truck with hinged side, and so on. Caster wheels are supplied as required in either semi-steel, drop forged steel, malleable iron, cast steel, textolite, Divine cushion, rubber, or with rubber tires, and in sizes best suited to the job. Copies of the catalog are available to mechanical plant executives without charge.

Prest-O-Lite Torches

Prest-O-Lite Torches. Illustrated. 3½ x 6. Published by The Linde Air Products Company, New York.

This publication will be of great interest to electricians, mechanics, plumbers, mechanical refrigerator men, telephone linemen, garages, dentists, and to all others who are interested in economical and efficient soldering, brazing and heating equipment. It contains descriptions and illustrations of the complete range of Prest-O-Lite equipment for soldering, brazing and heating requirements. The range of applications and types of work for which Prest-O-Lite equipment is especially convenient are described in detail.

ACTUAL "PROBLEMS" IN TRANSMISSION

How Would You Solve Them?

No. 1 · A Cleaner for Bent Tubes

THE PROBLEM was to find an element of transmission by means of which an electric motor could be used to drive a stiff brush through long bent tubes for performing a thorough cleansing job.

Tubes measured 1.032" inside diameter and were 15 feet long. The bend had a 5" radius. Desired speed of wire brush was established at 1,750 r.p.m. As tubes were generally wet and at high temperature when they were cleaned, the transmission element had to be unaffected by these conditions.

How this problem, and others equally interesting, were solved in a simple and thoroughly successful manner by the use of flexible shafts, is told in detail in the FLEXIBLE SHAFT APPLICATIONS "Problems and Solutions" book. Your request, on your business letterhead, will bring you a copy — free. Write for it — today.

The S.S.WHITE Dental Mfg. Co.
INDUSTRIAL DIVISION
150A West 42nd Street New York, N. Y.

IDEAS FROM READERS

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . We will pay for each one published.

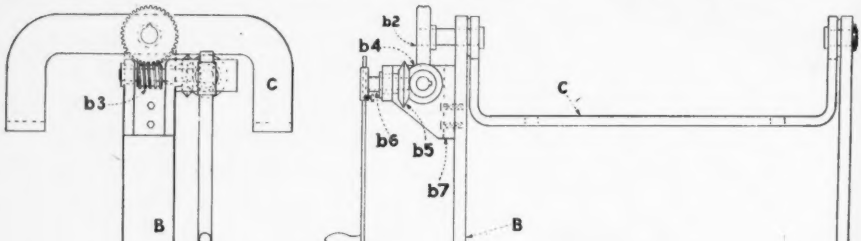
Repair Stand for Compound Air Compressors

By H. H. HENSON

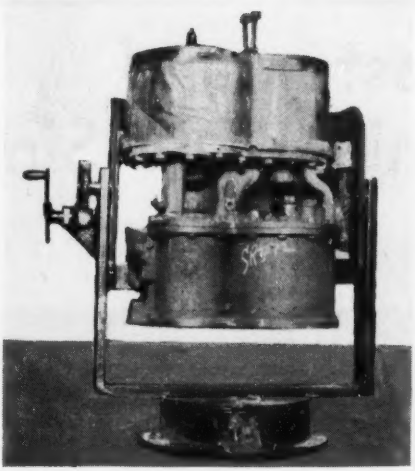
A COMPOUND air compressor for a locomotive is a cumbersome unit, and unless a stand of special design is available in which to hold the unit while making repairs, the use of a crane and the services of two or more men may be required to place the unit in the various working positions. The drawings and photographs illustrate the design of a stand in which, by the simple operation of turning a crank, a compressor unit may be placed in any required position.

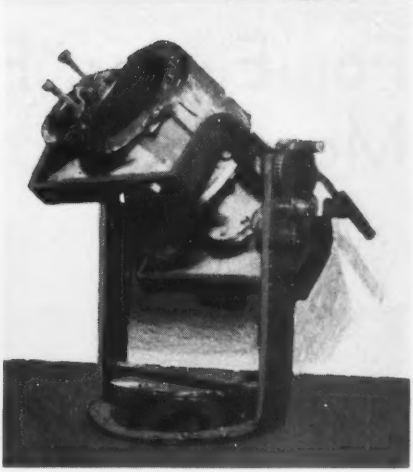
No involved mechanisms are necessary for the construction of such a stand; it consists primarily of a base **A**, a main frame **B**, and a cradle **C**. The main frame revolves vertically on the base, and the cradle — into which the compressor is clamped — can be revolved in a horizontal plane, thus making it possible to locate the unit in any position that will be most convenient for the mechanic. The frame rides on roller bearings in the base, upon which it is swung. The cradle is revolved by the turning of a crank, the crank being attached to a shaft carrying a worm which meshes with a worm wheel on the shaft which forms the axis of the cradle.

The construction of the base includes the base plate **a2**, bearing housing **a3**, foot pedal **a4**, swivel pin **a5**, and roller bearings **a6**. The base plate has six holes by which it may be anchored to the floor. The roller bearing is made by using two cylin-

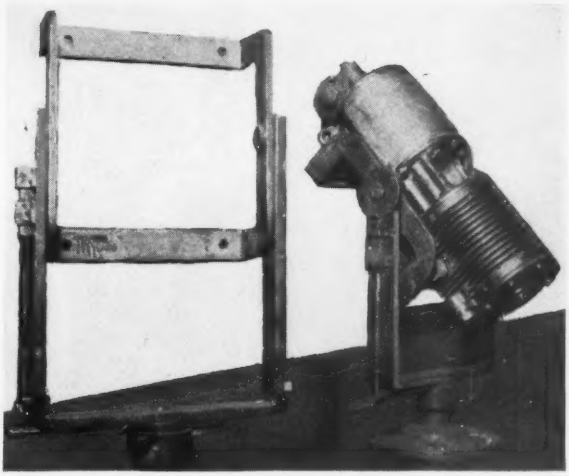


Design of repair stand for use in repairing compound air compressor units.





Showing how the stand is used and the different positions in which it may be placed for convenience in working on the compressor units.



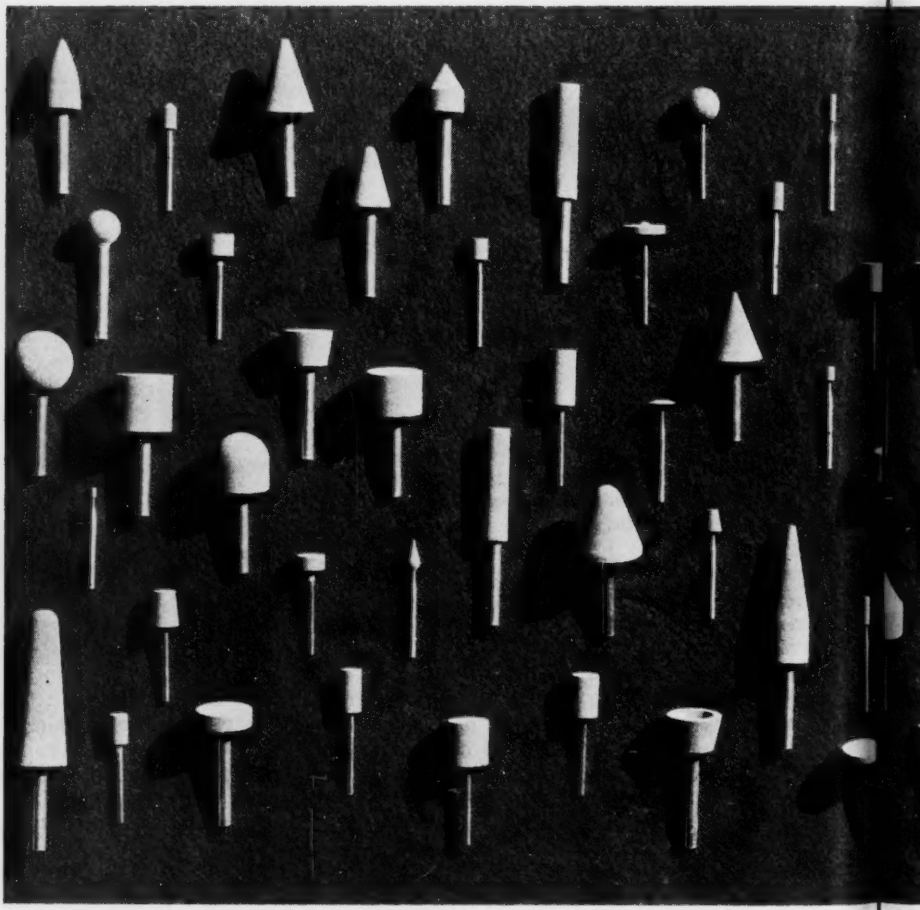
ders of ¾-in. steel, five inches wide, as the inner and outer housings, one 22 in. outside diameter and the other 12½ in. inside diameter, and setting into these housings four rollers which project ¼ in. above the upper faces of the housings. The housings are held in the correct relation to each other by four spacers consisting of 3⅛ in. lengths of ¾-in. pipe through which bolts are inserted and anchored.

Resting on the rollers is the lock plate **D**, which carries the frame and cradle. The plate is of ¾-in. steel and is 22 in. in diameter, with eight 1-in. slots cut into the edge at even intervals to receive the latch that is controlled by the foot pedal **a4**. The frame is held central with the lock plate by the swivel pin **a5**, which is screwed into a threaded hole in the bottom of the frame and locates in the center hole of the lock plate.

The frame is a section of 1¼-in. bar iron, bent to form a U with sides that are 30 in. long and 38⅝ in. apart. The cradle is of ⅞-in. bar iron, forged to receive the compressor unit as shown in the drawing. The

For Easier, Faster and More Economical Die Sinki

Use Thes



ki . . .

hes orton Mounted Wheels and Mounted Points

YOU'LL find these Norton Mounted Wheels and Mounted Points mighty handy for all kinds of die sinking and metal pattern making. They quickly and easily remove stock and leave a clean, smooth surface. The many available shapes make it possible to reach the hard-to-get-at places.

The cutting material in Norton Mounted Wheels and Mounted Points for die work is 38 Alundum abrasive — long famous for its grinding ability on hard, tough tool steels and steel alloys.

The spindles are made of a special steel and are first copper plated and then nickel plated. A chisel end on the spindle and a special cement assure a securely anchored mount — allowing Norton wheels and points to be used down to a very small stub.

Send for a catalog of Norton Mounted Wheels and Mounted Points—no charge or obligation.

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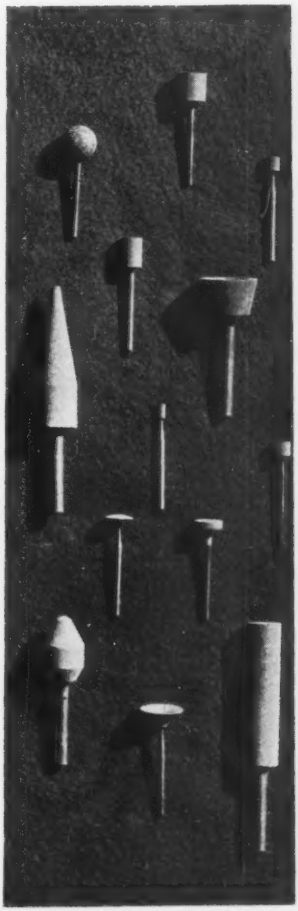
ABRASIVE PRODUCTS

W-446



cradle swings on trunnions, one of which carries a 6P, 40T cast iron worm gear **b2** that meshes with a steel worm **b3** on a cross shaft. The cross shaft also carries a bevel gear **b4** that meshes with a corresponding bevel gear **b5** on the hand crank shaft **b6.** Both shafts are supported by a bracket **b7** that is bolted to the frame.

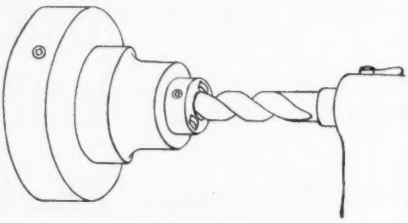
When a compressor unit is bolted into the cradle and placed in the horizontal position, any of the parts can be removed. In the angular position, the packing rings can be properly fitted to the cylinder bores. The cylinders can also be rebored by holding the unit in a horizontal position in the stand and using the portable boring bar, making it unnecessary to move the unit to the machine shop.

An Effective Drill Stop

By CHAS. H. WILLEY

THE drawing shows the design of a stop that is especially useful in drilling work to a predetermined depth, particularly where the drilling is to be done in a lathe. The stop is made from a section of round steel, drilled and reamed to provide clearance for the size of drill for which it is intended, and equipped with a clamping screw and two rollers. The clamping screw is a headless setscrew, and the rollers are two discs of hardened steel, drilled through the center for the holding pins, and ground to perfect concentricity. The rollers are set into slots in the stop, on opposite sides of the center hole, and are pinned so that they project an equal distance from the stop.

With this stop properly located on a drill, when the drill has been fed into the work to the correct distance, the stop blocks the drill from entering farther. The smooth rollers ride on the face of the work as the drill



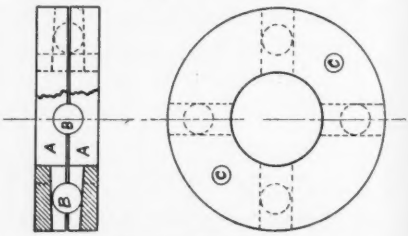
Drill stop in position on a drill.

revolves and, although serving effectively as a stop, do not mar the work.

A Self-Adjusting Spacing Collar

By R. H. KASPER

THE illustration shows the design of a spacing collar that was developed to prevent end play in a shaft that is operated at high speeds. Although the end thrust is very light, not even the slightest amount of end play is permissible at any time. As it was impossible to prevent wear, due to the high speed of the shaft,



Self-Adjusting Spacing Collar.

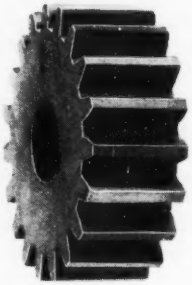
it was necessary to find some method of making end play impossible.

Two collars, **A,** were made of steel and hardened. In the contacting faces of the collars four corresponding grooves were ground, at such an angle that the holes thus formed are smaller at the outer ends than at the

STOP THAT NOISE!

WITH

FORMICA Non-Metallic GEARS



Noisy machinery is harder to sell than silent —and rightly so!

Formica gears and pinions reduce greatly the operating noise of most devices and that is why it is used more widely all the time. It provides quiet without sacrificing durability. It reduces weight of rotating parts. It inserts an elastic member in the drive which saves the machine.

Formica helps the maintenance man to keep the machinery under his care operating smoothly and quietly.

The gear cutters named below can give prompt service on one or many Formica gears.

THE FORMICA INSULATION COMPANY
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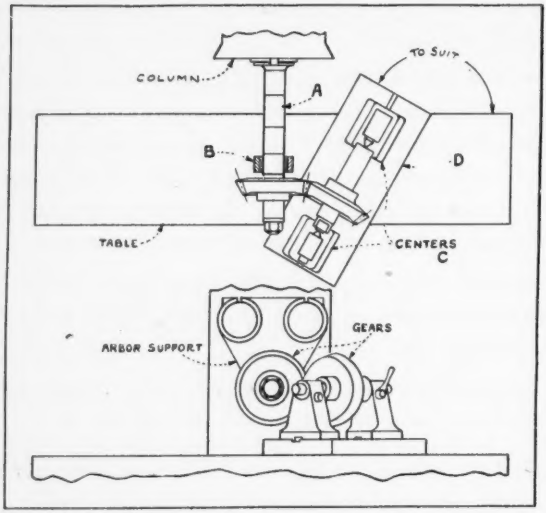
FORMICA GEAR CUTTERS

The Akron Gear & En'g Co., Akron, Ohio
Farrel-Birmingham Co., Inc., Buffalo, N. Y.
Slaysman & Company Baltimore, Md.
Harry A. Moore Bangor, Me.
The Union Gear & Mch. Co., Boston, Mass.
The Atlantic Gear Works Brooklyn, N. Y.
Chicago Rawhide Mfg. Co. Chicago, Ill.
Perfection Gear Company Chicago, Ill.
Merkle-Korff Gear Co. Chicago, Ill.
Chicago Gear Company Chicago, Ill.
The Cincinnati Gear Co. Cincinnati, O.
The Greaves Mch. Tool Co., Cincinnati, O.
The Horsburgh & Scott Co. Cleveland, O.
The Stahl Gear & Mch. Co. Cleveland, O.
The Master Electric Co. Dayton, O.
The Adams Comany Dubuque, Ia.
The Ferguson Gear Co. Gastonia, N. C.
Excello Machine Co. Grand Rapids, Mich.
Hartford Special Mchny. Co., Hartford, Conn.
Precision Machine Co. Milwaukee, Wis.
Joaquin Alemany Lopez Havana, Cuba
The Dedman Foundry & Machine Co. Houston, Tex.
The Generating Gear Co. Milwaukee, Wis.
Mobile Pulley & Machine Works, Mobile, Ala.
Berkley Machine Works & Foundry Co., Norfolk, Va.
Meisselbach Catucci Mfg. Co., Newark, N. J.
Sier-Bath, Inc. New York City, N. Y.
E. M. Smith Mch. Shop Peoria, Ill.
The Earle Gear & Mch. Co., Philadelphia, Pa.
Rodney Davis and Sons Philadelphia, Pa.
The Pittsburgh Machine & Supply Co. Pittsburgh, Pa.
Standard Gear Co. Pittsburgh, Pa.
The Turley Gear & Mch. Co., St. Louis, Mo.
Perkins Mch. & Gear Co. Springfield, Mass.
Winfield H. Smith, Inc. Springfield, N. Y.
Alling Lander Company Sodus, N. Y.
Charles E. Crofoot Gear Corp'n South Easton, Mass.
Arlington Machine Co. St. Paul, Minn.
Farwell Mfg. Co. Toledo, Ohio
Diefendorf Gear Corp. Syracuse, N. Y.
Worcester Gear Works Worcester, Mass.
Massachusetts Gear Tool Co., Woburn, Mass.

inner ends, and of a size that will just admit a steel ball at the inner end when the collars are in contact. Thus though the radius of the grooves is constant throughout their entire length, the depth of the grooves decreases toward the periphery of the collars.

The two collars **A** are placed with the grooved faces together, in which position they are held by the pins **C**.



Drawing showing set-up for lapping gears in a milling machine.

The pins are free in one collar and tight in the other, so that the collars may be moved axially with each other. When the assembly was placed on the shaft, a steel ball was placed in each groove. One of the collars **A** was pressed into a recess in the revolving part on the shaft, while the other collar was placed in contact with one of the bearings which carried the shaft. As the shaft revolves, the balls are thrown outward by centrifugal force and the collars are separated; thus the space is filled and the possibility of end play is eliminated regardless of wear.

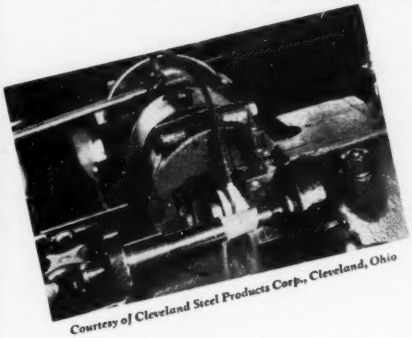
Convenient Method for Lapping Gears

By JOHN MCCULLAGH

IN shops where special machinery is made, the milling machine will be found useful for lapping gears of all kinds. The accompanying illustration shows a setup for running in two obtuse bevel gears. One of the gears to be lapped is assembled on the arbor **A**, close to the arbor bearing **B**, while the other gear is mounted on a mandrel and supported between the centers **C**. The centers are attached to the baseplate **D**, which is clamped to the milling machine table.

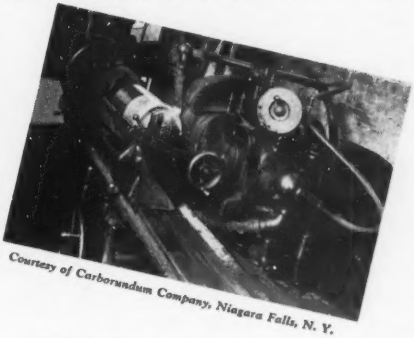
The gear assembled on the arbor is driven by the machine spindle, and it in turn drives the mating gear which is mounted between centers. The proper pitch contact is easily made by adjusting the table longitudinally and the saddle crosswise, after the base-plate has been clamped at the correct angle. The centerlines of the arbor and the centers are, of course, set at an even plane.

With the gears running, a suitable lapping compound is applied to the teeth. Lapping is continued for several minutes and if a tighter contact is needed, it is only necessary to adjust the machine table a thousandth of an inch or so and then continue rotation. The operation will quickly remove all high spots on the teeth and aid in producing quiet-running



Courtesy of Cleveland Steel Products Corp., Cleveland, Ohio

OPERATION: MILLING THREAD ON SPLINE SHAFT
MACHINE: LEES-BRADNER.
MATERIAL: S. A. E. 3135 STEEL
PRODUCTION. 30 PIECES PER HOUR.
LUBRICANT: 1 PART SUNOCO TO 15 PARTS WATER.



Courtesy of Carborundum Company, Niagara Falls, N. Y.

OPERATION: GRINDING STEEL ROLL. 9 IN. DIAMETER, 18 IN. LONG.
MACHINE: LANDIS ROLL GRINDER, 12 IN. X 72 IN.
SCLEROSCOPE: 94 TO 101.
WHEEL SPEED: 1700 R. P. M.
WORK SPEED: 40 R. P. M.
COOLANT: 1 PART SUNOCO TO 30 PARTS WATER.

Accuracy Maintained *with* Long Runs Between Tool Grinds

THE increasing necessity for lower production costs places upon Machine Shop Executives the obligation of selecting cutting lubricants of known quality and proven worth.

Economical operation and profits are dependent upon continuous machine tool performance.

The service that Sunoco Emulsifying Cutting Oil renders many leaders in the metal cutting industry in reducing the cost of production is at your disposal for operations in your plant.

Increased machine speed, longer runs per tool grind, less lost time for resetting, reduced tool maintenance, greater accuracy and better finish are the reasons for the increasing use of Sunoco by the automotive industry, nut and bolt industry, gear manufacturers and steel plants.

We invite your correspondence and cordially offer you the assistance of our experienced Cutting Oil Engineers.

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Sun Oil Company, Ltd., Montreal, Canada
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gears, providing the teeth have been cut accurately. Likewise any minor distortion resulting from heat treating will be corrected.

For the same setup a universal machine could be used, in which case the baseplate would be mounted at right angles on the table and the machine table set to the angle required. The same method can be used equally well with spur gears as well as bevel gears. For hypoid bevel gears the machine table is lowered to the correct center distance and the gears lapped in the same manner.

Soaking of Carbon Tool Steels

By CASPAR ARCH

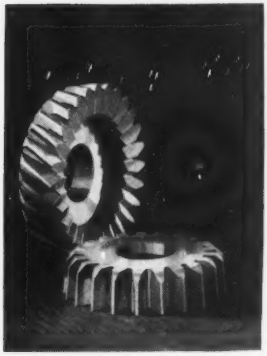
MOST authorities agree that in hardening straight carbon tool steels, the parts should be but slightly "soaked" at the hardening temperature. The only purpose of any soaking is to insure a uniform temperature through the entire section of the piece, as a hot exterior and a cooler interior is one of the most frequent causes of cracking. It must always be remembered that the pyrometer merely indicates the temperature of the furnace in the immediate vicinity of the thermocouple, and not the temperature of the piece itself.

Although the work may be brought to temperature with the furnace, there will always be a certain amount of temperature lag, depending upon the volume of the piece being heated. When the pyrometer indicates that the interior of the furnace has reached the proper temperature, it is necessary to allow the work sufficient time to overcome the lag before withdrawing it for quenching. As the volume of the work may vary considerably, the time element must vary correspondingly, and therefore will always be rather indefinite.

The following method of determining the proper soaking time eliminates guesswork and is general practice in one of the largest steel mill laboratories. When the work appears to be heated uniformly, it is lifted from the floor of the furnace and the color of the furnace floor, where the piece lay, is noted. If a dark spot is visible, the piece is not ready for quenching, as it indicates that the interior of the piece, being cooler, absorbs heat from the exterior, which, in turn, absorbs heat from the furnace floor. When a dark spot no longer appears upon lifting the piece, it indicates that the entire section is of the same temperature as the furnace floor, and the piece is ready for quenching.

Norton Mounted Grinding Wheels and Points. Norton mounted wheels and mounted points in shapes and sizes to meet all demands of industrial grinding in which this type of product is used are described and illustrated in this booklet, which has been issued by Norton Company, Worcester, Mass. The wheels and points, which are of the vitrified bonded 38 Alundum abrasive, are shown in the natural red color, with the dimensions indicated on the illustrations. Complete descriptions of the wheels and spindles, with dimensions of the latter, are included. A plentiful use of aluminum ink provides an attractive background for the text and illustrations. Copies free.

"Chicago" Grinding Wheels On Shanks. "Chicago" grinding wheels in various shapes and sizes up to 3 in. shanks, are described and illustrated in this booklet, which has been issued by Chicago Wheel & Mfg. Co., 110 South Aberdeen Street, Chicago, Ill. Types of wheels to be used for the grinding of various materials, together with the wheel speeds, are indicated in a table, and complete tables are given for the various types of wheels, showing the prices for the different sizes. A page of instructions for the use of these small wheels is included. Copies free upon request.



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Continuous improvements in the quality and accuracy of **Original Fellows Gear Shaper Cutters** now assure you more gears per cutter, lower cutter costs per gear, and fewer gear rejects.

Users of Fellows products have at their command highly-developed inspection equipment. If for no other reason than this, you should standardize on ORIGINAL FELLOWS GEAR SHAPER CUTTERS. As one user so tersely states: "Your cutters are consistently better - - - we know you can duplicate any satisfactory shape indefinitely."

ORIGINAL FELLOWS CUTTERS are made in many types and sizes, each cutter being specially adapted to the exacting work it is intended to perform. Any Fellows Representative is willing to help you with your gear problems. Write:

THE FELLOWS GEAR SHAPER COMPANY

78 River Street, Springfield, Vermont
(616 Fisher Building, Detroit, Michigan)

FELLOWS
~ GEAR SHAPERS ~

Over the Editor's Desk

Increased Visibility

IF the type and illustrations in this issue of MODERN MACHINE SHOP seem clearer, that fact should not be taken as an indication of suddenly improved eye-sight; it simply means that another step has been taken in the program to give our readers the best and best-printed machine shop magazine that can possibly be produced. Beginning with this issue, the magazine will be printed on the best grade of light weight enamel paper that can be had. By using this fine paper, together with the finer grade of ink which is necessary for best results, every last bit of detail in the illustrations can be brought out. MODERN MACHINE SHOP is, in every sense, a quality magazine.

Reduction of Mental Fatigue

INDUSTRY has long recognized that the elimination of waste is quite as important as increased production. The attention of manufacturing executives has been focused fully as much on saving as it has on "making," and production engineers recognize that saving time is necessary to increased production.

In order to aid the worker in turning out more work and to help him to maintain a high rate of speed throughout the working day, everything possible is being done to reduce the amount of manual labor required, particularly where considerable effort is required, such as in the lifting of heavy parts, operation of heavy vise-jaws, clamping of jigs, and so on. Air and electricity have both been pressed into service to perform as many of the laborious tasks as possible and engineers are constantly devising new ways to apply these useful servants.

Another factor that is taken into consideration is the importance of keeping the men on the job. It has been estimated that it costs approximately $60 to hire a man and fit him into the job, this figure including the cost of the clerical work necessary to make out records, the cost of extra supervision because of his unfamiliarity with the task and surroundings, the loss in parts that will be spoiled before he becomes efficient at the task, and the cost of the loss in production while he is becoming familiar with the job. Therefore it is important that blowers be installed to carry off dust, gases, or fumes; that respirators be supplied where blowers are impractical or where they do not clear the air sufficiently, and that all disagreeable features, including heavy labor, be eliminated as far as possible.

Thus physical discomfort has received a large share of attention and the task has been made as easy as possible, but it has only been recently that the attention of industrial engineers has been turned to the cost of mental fatigue. The fatigue which results from the use of the brain over a period of several hours is natural and cannot be avoided, but in many cases the strain of concentrating on the task is doubled due to extraneous noises, such as result from the operation of air-riveters, steam hammers, or machinery in which the gears clash and grind.

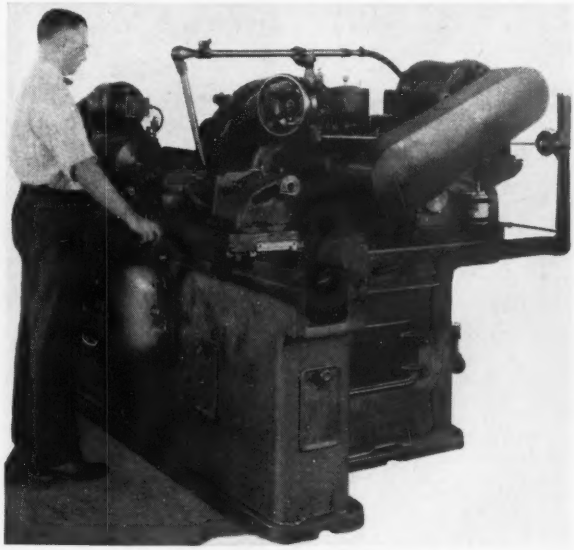
The matter of noise and its effect on workers is, however, coming in for an increased amount of attention. No conclusive amount of research has been made as yet, but the importance of the subject is becoming recognized and it is only a matter of time until the matter will be taken up and definite tests made to determine exactly how detrimental noise is to the nerves of those in its immediate vicinity.

NEW SHOP EQUIPMENT

Landis Type C 10-In. Plain Hydraulic Grinder

The Landis Tool Company, Waynesboro, Pa., has brought out a 10-in. plain hydraulic grinding machine to supplement the 6-in. machine of the same type announced some time ago. As the designation by the same type letter would indicate, the general characteristics of the two machines are the same, although the proportions of the 10-in. machine are naturally greater. Such work as motor armatures, shafting, and camshaft line bearings may be considered as typical jobs for this machine, and it is particularly recommended by the manufacturers for the grinding of crankshaft line bearings of practically all shafts excepting the very large and heavy ones.

The machine is of symmetrical design, compact, and well balanced. It is entirely self-contained and, like the 6-in. size of the same type, provides exceptional ease of control. The controls are grouped so that all of them can be reached from the operating position, without undue stretching.



Landis Type C 10-In. Plain Hydraulic Grinder.

A high degree of flexibility adapts the machine particularly for modern manufacturing needs. A large variety of parts may be ground on the standard machine, and by using special attachments—which are available—the range and production of the machine may be increased. The wheel base or headstock may be set at an angle. Should the nature of the work require, crank heads may be had. Semi-automatic operation can be obtained through the use of a foot pedal control, and full automatic operation is available when required. Straight infeed grinding is said to present unusual advantages because of the hydraulic straight infeed mechanism. Formed wheel grinding and multiple wheel grinding are other types for which the machine is well fitted.

Accessibility to the various mechanisms for inspection, adjustment, or repair is an important feature of the machine. By removing the cover at the front of the machine, all control mechanisms are exposed, none of them being entirely within the bed. The removal of a single cover makes the wheel drive accessible, and the removal of a single cover at the front of the wheel base exposes the wheel spindle bearings and their oil pump. The pump mounting at the rear of the machine is also accessible.

The hydraulic table traversing mechanism is of the twin cylinder type,

designed so that the volume of oil in the cylinders is constant regardless of the direction of traverse. Table speeds range from 6 in. to 240 in. per minute. The bed is of box-type construction, well webbed. The work carriage traverses on a flat and a V guide, for which lubrication of the flood type is provided. The grinding wheel head is also supported by one flat and one V guide. Steel back babbitt wheel spindle bearings are used, with continuous lubrication. All oil is filtered before entering the bearings.

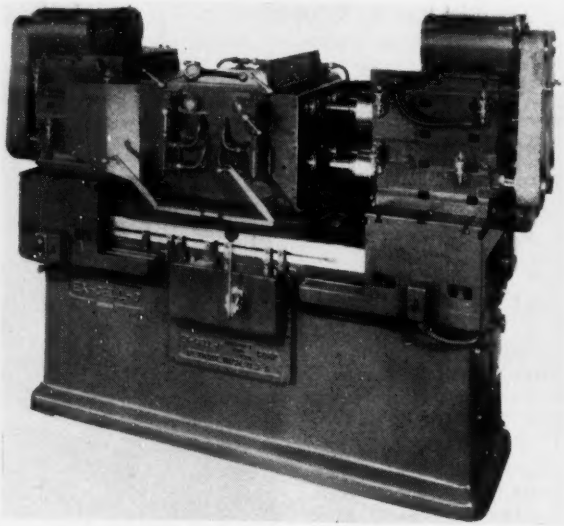
The wheel spindle is driven by V belts from a 10 h. p. motor, which is mounted on an adjustable plate at the rear of the wheel base. Standard equipment includes a 30 x 3 x 12-in. straight side grinding wheel.

The oil and water pumps are mounted in line and are driven by a constant speed 1 h. p. motor. The wheel feed is of the conventional Landis type, and automatic wheel feed may be had upon special order. The headstock is driven by a constant speed ½ h. p. motor, six work speeds being available by changing pulleys and belts at the left-hand end of the head. Net weight of the 10 x 18-in. machine, without motors, is 6,700 lb. The 10 x 36-in. size weighs 7,200 lb. and the 10 x 48-in. size, 7,700 pounds.

Ex-Cell-O Precision Boring Machine Bores Steel

Ex-Cell-O Aircraft & Tool Corporation, 1220 Oakman Blvd., Detroit, Michigan, announces that steel can now be bored with both the single and double end Ex-Cell-O Precision Boring Machine. In developing this application, it has been found that steel parts which do not exceed a hardness of 250 Brinell, 36 Scleroscope or 24 Rockwell, can be successfully bored, providing the hardness of the steel is uniform and that the stock to be removed is well distributed throughout the entire bore.

The illustration shows the machine finish-boring both the large and small ends of a connecting rod in one operation. On the large end the material to be bored is steel, and on the small end, bronze. Approximately 0.018 in. to 0.020 in. of steel stock and 0.008 in. to 0.010 in. of bronze stock is removed in the same operation. The holding fixture is so designed that two rods are loaded at each end in a vertical position with the small end of the rod at the top. This enables the operator to load two rods at one end while two rods are being bored at the opposite end, eliminating the loading time.



Ex-Cell-O Precision Boring Machine adapted for boring both ends of a connecting rod in one operation.

An inbuilt direct-connected electric motor drives the unit for boring the bronze end of the rod. This unit is located at the top of the mounting bracket. At the bottom of this bracket is located a belt-driven boring spindle for boring the steel end of the rod. The motor for driving this spindle is mounted on top of the bracket. By means of the belt-driven spindle, the proper boring speed can be obtained for the steel application. There are two sets of these units at each end of the machine.

Each of the boring spindles is of the replaceable quill type, enabling the

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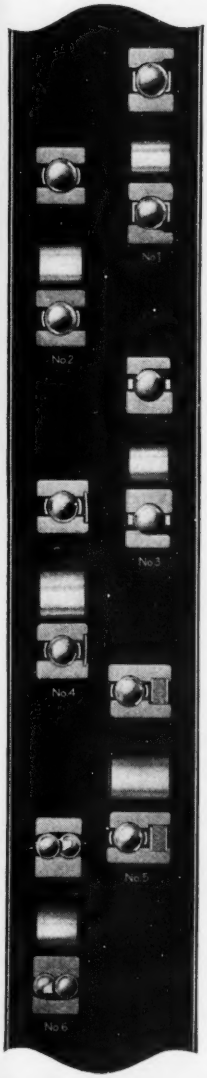


For PRODUCTION AT LOWER COST

THIS is the objective of every executive, engineer and designer; and the performance of the bearings in a production machine is a vital factor in keeping costs down. * * * * But, in comparing bearings, look beyond first cost—look to the ultimate cost over a period of years. Let proved performance point the way to your decision. * * * * For over 20 years, in every field of industry, Norma-Hoffmann **PRECISION** Bearings have been making distinguished records for unfailing dependability—records which command the confidence of those who seek the lower production costs that come with the use of better bearings.

PRECISION BEARINGS

For Every Load, Speed and Duty

NO one type of bearing is so versatile in its operating characteristics that it will meet all conditions; the conditions should determine the type of bearing used. From the comprehensive **NORMA-HOFFMANN** line—here illustrated in part and briefly indexed—a **PRECISION** Bearing, or several in combination, can be chosen that will be exactly right for the duty. Let our engineers, with their specialized experience, work with you in selecting and applying bearings that will lower your production costs. Write for the Catalog.

1—Open (separable) type ball bearing.

2—Closed radial type ball bearing.

3 — Angular contact ball bearing.

4—Single-plate grease-retaining, dirt-excluding ball bearing (available in double-plate type also).

5—"7000" Series "Greaseal" felt-protected ball bearing.

6—Double-row, self-aligning ball bearing; also furnished with adapter sleeve and nut.

7—Standard cylindrical roller bearing.

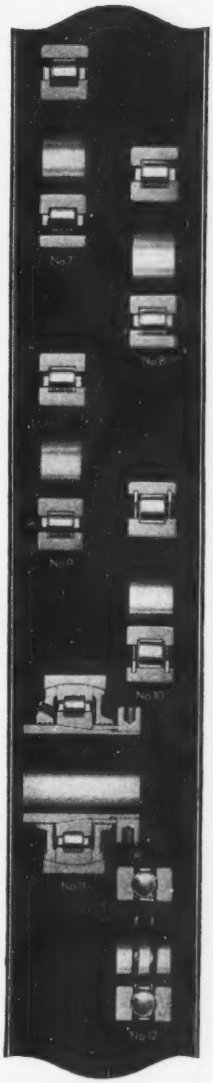
8—One-lipped cylindrical roller bearing.

9—Two-lipped cylindrical roller bearing.

10—Full type (retaining ring) cylindrical roller bearing.

11—Self-aligning adapter type cylindrical roller bearing with grease-retaining, dust-and-moisture-excluding side plates.

12—Ball thrust bearing.



NORMA-HOFFMANN BEARINGS CORP'N - Stamford, Conn., U. S. A.

operator to keep an extra set of sharp boring tools available at all times. The maintenance of sharp tools properly designed is an important factor in determining the successful operation of this machine.

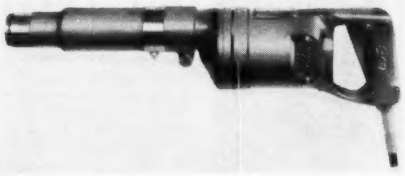
"Cimatool" Spiral Gear Workhead for Peerless Gear Chamfering Machine

The City Machine & Tool Works, 1521 East Third Street, Dayton, Ohio, announces an improvement to the standard workhead for the Peerless Gear Chamfering Machine (made by this firm) which permits the chamfering of spiral or helical gears on a rapid and economical basis. The workhead is to be marketed under the trade name "Cimatool." Developed particularly for the chamfering of helical gears, the workhead is equally adaptable to spur gears and with a slight change it can be applied to all No. 3 Peerless machines.

Although developed primarily to meet the usual thrust of spiral gears, this feature in no way limits the capacity or the flexibility of the machine. With an anti-friction bearing idler drive, the head can quickly be readjusted to meet the varying diameters of gears. The workhead has been thoroughly tested by actual usage in the field.

"Thor" Electric Hammer

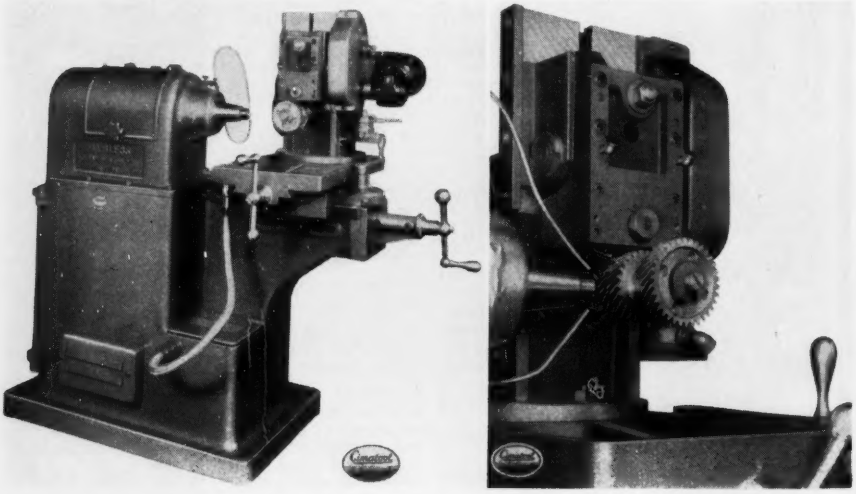
The Independent Pneumatic Tool Company, 604 West Jackson Blvd., Chicago, Ill., has augmented its line of



"Thor" Electric Hammer.

"Thor" tools by the addition of the tool shown in the illustration. This tool is to be known as the Thor Electric Drill, but it is really a double purpose tool —it can be used either as a drill or as a hammer. It can be used to drill, chip, and channel concrete, brick, wood, and so on.

It will also chip steel and drive light rivets. In hard limestone, this tool will drill a ¾-in. hole 1¾ in. deep in one



(Left)—Full view of Peerless Chamfering Machine with improved workhead. (Right)—Close-up view showing tool in cutting position for chamfering teeth on a helical gear for an automobile transmission.

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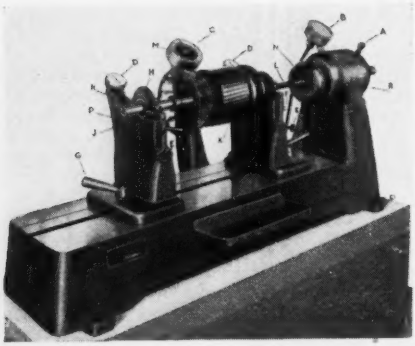

A NEON LITE locates the unbalance instantly with only one direction of rotation; **NO PENCILS.**

Balances to an accuracy heretofore considered impossible.

The only machine successful on small armatures.

Built in sizes to handle work from 1" to 96" in diameter; for weights from ¾ ounce to thousands of pounds.

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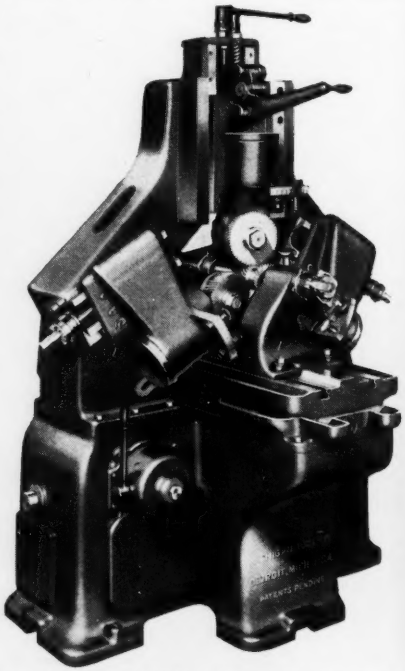
Mfrs. of Special Machinery, Die Castings, Static and Dynamic Balancing Machines, Armature Winding Machines.

minute, using the standard taper shank drill with holder. This time can be cut in half if the drill is solid with straight shank, so that it can fit directly into the hammer without the use of an adapter.

The hammer delivers 3,000 blows per minute. It is 18 in. in length, overall, and weighs 16 pounds. Equipment includes a ¼-in. Jacobs chuck, $\frac{5}{16}$-in. star drill, tool holder, ejector pin, and carrying case.

"Michigan" Gear-Lapping Machine

Three laps are used in a gear-lapping machine recently designed by the Michigan Tool Company, 7175 Six Mile Road



Gear-Lapping Machine in which the work is rotated between three laps.

East, Detroit, Michigan. These laps are spaced about equally around the work. Each of them may be set with its axis at an angle to the axis of the work, thereby producing a sliding action between the lap and gear teeth. The

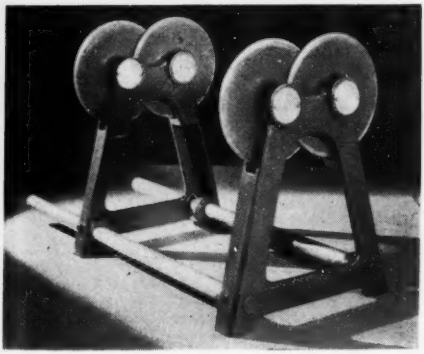
upper lap is raised and lowered by means of a handle for loading and unloading the machine.

A hydraulic brake on each lap-spindle may be set to almost any predetermined pressure for speeding up lapping operations. The headstock and tailstock for supporting the work, either between centers or stub arbors, are mounted on a table which is oscillated at various speeds. It is claimed that this function insures even lapping throughout the full length of gear teeth. Reloading is facilitated by an 8-inch movement of the tailstock spindle.

The machine is almost entirely automatic. Means are provided in the control box for setting the length of time it is desired to lap each side of gear teeth. The time may be equal for each side, or different. The machine can be set to automatically change from lapping one side of the gear teeth to lapping the opposite side. It is claimed that a production of about fifty gears of 10 pitch and 3-in. pitch diameter can be obtained per hour.

"Globe" Static Balancers

To meet the demand for an accurate, sensitive tool for static balancing, the Globe Tool & Engineering Company, 402 Davis Ave., Dayton, Ohio, has brought out the two tools shown in the accompanying illustrations. The Self-Leveling Static Balancer Series "B" is made with chilled iron discs upon which the work rests while being balanced. The discs are accurately balanced and are mount-



Globe Series "B" Self-Leveling Static Balancer

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Ross Operating Valves

Poppet type with renewable seats, and sealed by air pressure, assuring exceptional speed, easy control, coupled with safe operation over a long period of use.

All ports being on one face, Ross Operating Valves may be mounted on a plate to which the piping is attached, thus making the piping a permanent installation. To remove the valve merely loosen the bolts.

Made for the control of single and double acting cylinders in all pipe sizes ranging from ⅜" to 1¼". Hand or foot control.

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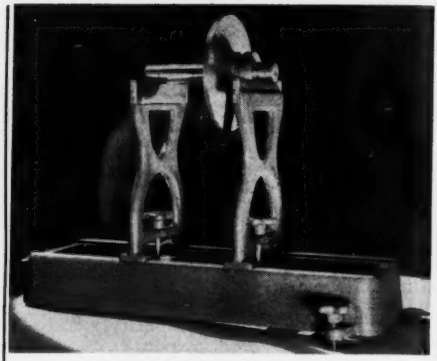
ed on spindles which, in turn, are mounted in special frictionless ball bearings. It is not necessary to level this tool in order for it to work perfectly. The tool can be had in sizes to swing up to 96 in. diameter, adjustable to 80 in. between standards, and in capacities up to 10,000 pounds.

The Super-Sensitive Balancer Series "C" is provided with hardened and ground knife edges to hold the work for balancing, and is mounted on a base that



Globe Series "C" Super-Sensitive Static Balancer

is provided with three quick-adjustable leveling screws for quick and accurate leveling. This tool may be had in sizes to swing work up to 96 in. diameter, adjustable to 80 in. between standards, and for capacities up to 4,000 lb. It can be furnished with built-in two-way levels, if desired.

G.D.S. Model 50 Rod-Cutting Machine

The rehandling of reinforcing bars for concrete jobs can now be done away with by the use of the Model 50 G.D.S. Lever Rod-Cutting Machine shown in the illustration. This machine is made by the G.D.S. Shearing and Punching Machine Co., 101 Walker St., New York, N. Y.

The machine is manufactured entirely from high grade steel plates and drop

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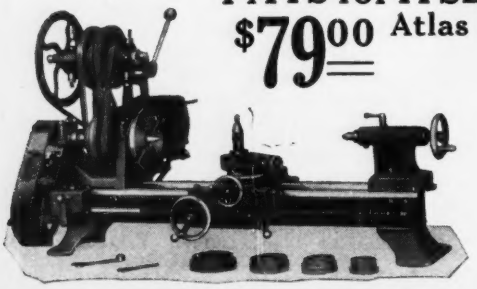

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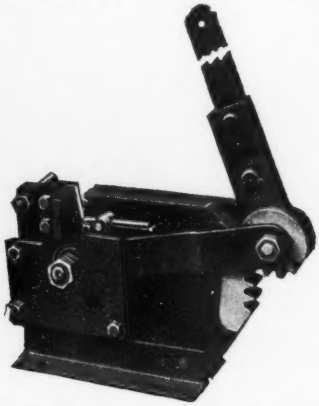
forgings, and is guaranteed to be unbreakable. It is small enough in size so that it can be taken to the job, yet is strong enough to cut bars from $\frac{5}{8}$ in. to



G.D.S. Model 50 Lever Rod-Cutting Machine.

1 in. in diameter or square rods from $\frac{9}{16}$ in. to $\frac{15}{16}$ in. The net weight of the machine varies from 37 pounds for the smallest unit to 164 pounds for the largest. For easiest operation, the machine is mounted 20 inches from the floor.

Micro-Poise Precision Balancing Machine

The illustration shows the Micro-Poise Precision Balancing machine, which has been developed by the Commerce Pattern Foundry & Machine Co., 2213 Grand River Avenue, Detroit, Michigan, for balancing fly wheels, fans, automobile wheels, clutches, and similar mechanical parts in which the face is narrow in proportion to the diameter of the piece. The design of the machine is based on the principle that a rotating part having a face that is narrow in proportion to its diameter contains no appreciable dynamic couple and consequently can be put into running balance by simply weighing and removing the excess stock in the heavy side of the piece.

The machine is delicately adjusted and will weigh very small amounts of unbalance. It is said that a flywheel weighing 60 lb. can be balanced within a limit of 0.2 ounce-inches. In order to obtain such fine accuracy, the pivoting mechanism is made to consist of a hardened ball resting on a hardened and

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A Production Tool for multiple-spindle machining when several holes are counterbored, drilled or reamed to the same depth.

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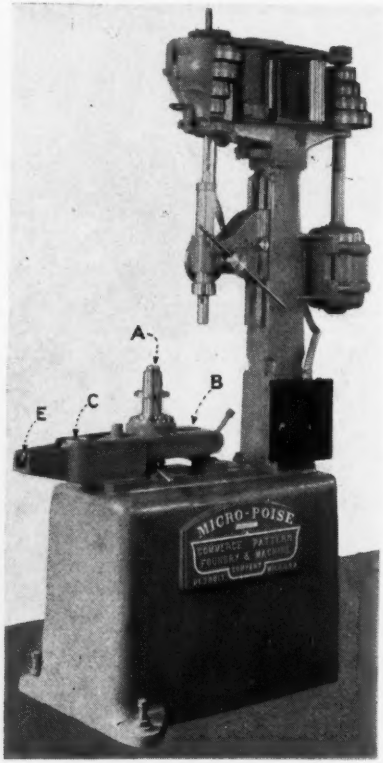
lapped plate. These parts are inherently accurate and fundamentally simple. The use of the ball and plate principle makes it possible to show instantly the angle of unbalance, and the excess material can be removed in a few seconds, without removing the piece from the machine.

The part to be balanced is placed on an adaptor located on the spindle **A**, which is located on the moveable table **B**. The table **B** is balanced on the ball so that it can tilt, instantly, in the direction of the heavy side of the piece. Thus the bubble in the spirit level **C** immediately moves to the side opposite the heavy spot in the work. The piece is then revolved to bring the heavy side directly under the drill spindle and a balance weight is moved out on the weighing beam **E** until the bubble lo-



Micro-Poise Precision Balancing Machine.

cates in the center of the universal level. At this point the number and depth of holes to be drilled is indicated directly on the weighing beam. The operating lever is used to lift and rigidly lock the table **B**, then the drill is used to remove the designated amount of material. When drilled, the work is checked by simply releasing the operating lever and observing the bubble in the level.

The machine can be adjusted to any degree of sensitivity; in fact, it is said that it can be adjusted to indicate the

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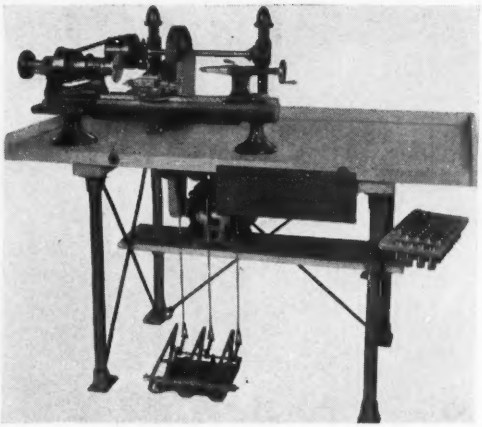

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Unit shipped completely assembled and wired for operation. Write for information—also ask for bulletins on Cataract Precision Bench Lathes, Hand Screw Machines and Bench Milling Machines for Laboratory, Toolroom and Production work.

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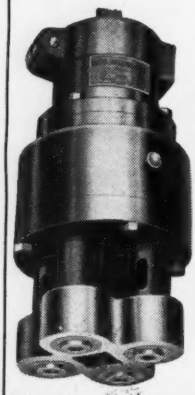
weight of a piece of paper one inch square.

In parts in which the axial length is great as compared to the diameter, however, the method described above will not suffice, as it is impossible to determine by gravity at what point in the length of the piece to remove the unbalance. The part must, therefore, be dynamically balanced, which is accomplished by placing the part in a machine in which it is revolved, one end being free to oscillate about a fulcrum that is located at a suitable point near the end of the part. It is stated that the Micro-Poise Dynamic Balancing Machine will weigh the amount of unbalance at a given point, and if the unbalance is corrected, the part, when replaced in the machine, will revolve without oscillating. To complete the operation, the part is turned end for end and the process is repeated. One of these ma-

Micro-Poise Crankshaft Balancing Machine.

MULTIPLE UNITS
FROM
SINGLE DRILLS



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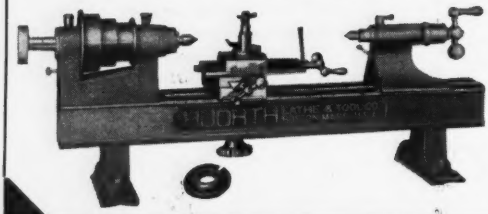

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HJORTH LATHE & TOOL COMPANY
60 STATE ST., BOSTON, MASS.

chines, made especially for crankshaft balancing, is illustrated. Summed up, this procedure demonstrates, according to the manufacturer of the machine, that a revolving part having a long axis can be balanced statically and dynamically by making corrections at selected points on or near the ends of the part.

Koebel Multi-Point Diamond Dresser

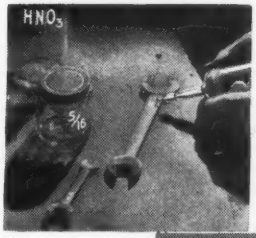
For dressing grinding wheels where high finish is required, especially on centerless grinders, roll grinding, and where other large wheels are used, the Koebel Diamond Tool Co., 1220 Oakman Blvd., Detroit, Michigan, has developed the Multi-Point Diamond Dresser shown in the illustration. In this tool a multiple number of whole diamonds are mounted in the face of a single tool in spaced relationship. In practice there are from two to five diamonds in contact with the wheel face, each doing its share of the work, but in the aggregate taking a cut of the same depth as would be taken by a single diamond. Obviously, the shallower penetration of

Koebel Multi-point Diamond Dresser.

a multiplicity of points tends to a smoother dressing with less wear on each diamond.

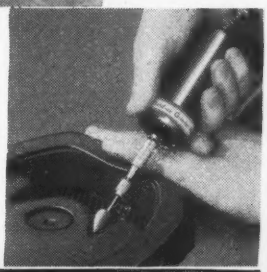
The advantage of the multiple dresser over a single diamond is said to be that the multiple tool cuts under less pressure, therefore damage to the bond is less and the wheel grains are not torn out in clusters. It is said that the use

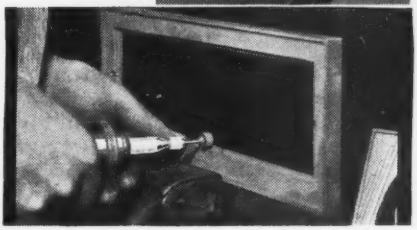
New Uses for the New Hand-ee Grinder



Parts of all kinds marked with the Hand-ee Grinder.

Touches off rivets, brazes, welds, solder, burrs, castings, etc.





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Send Hand-ee Grinder for 5-day trial. Price, $10.00, with 3 wheel shapes checked below.

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Company.....

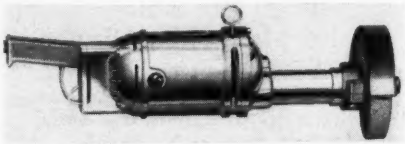
City.....State.....

of this tool makes possible longer wheel life, as waste is avoided, with better finish on the wheel.

The Koebel Multi-Point tool leaves the wheel in a free-cutting condition which makes possible the removal of stock from work with a minimum of wheel pressure, thus eliminating the tendency toward burning of the work and glazing of the wheel. The dresser is set with a number of points in contact with the wheel, at an angle of approximately either 3 deg. or 10 deg., and the dresser is rotated at intervals so that the points are kept sharp. The multiplicity of diamond points insures that the wheel will be dressed straight, and that no marks will be left in the wheel-face.

Millers Falls No. 461 H. S. Portable Grinder

A 6-in. high speed portable grinder, to be known as the No. 461, has been added to the line of portable tools made by the Millers Falls Company, Greenfield, Mass. The design of the tool is unique in that the totally-enclosed motor is so shrouded that the fan-generated air passes entirely around the motor—but not through it. This construction prevents the entry of dirt and grit to the motor and bearings, thereby increasing the life of the tool and decreasing maintenance costs. It is said that even with this radical departure



Millers Falls No. 461 H. S. Portable Grinder.

in design, the rise in temperature is very slight and well within the capacity of the universal motor.

The oversize ball bearings are of the improved grease-seal type, and the heavy duty switch, rated at 30 amp. at 250 volts, is totally enclosed. The gears are of chrome nickel steel, heat treated. The tool develops a no-load spindle speed of 5,500 r.p.m., and bakelite or rubber bonded wheels, designed for high speed operation, must be used.

The tool can be externally lubricated at both ends without disassembling. It is well balanced, weighs 24 lb., and although easily handled by hand, comes equipped with an eyebolt for spring suspension. The length of the tool is 23½ in., and the diameter of the wheel or disc used is 6 in. A 15-ft. length of 3-wire heavy rubber-covered cord with armored plug is supplied with the tool.

Eclipse Micro-Justable Holder

A new development in adjustable length holders for end cutting tools,

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Worms and Gears

insure smoother operation and greater durability for your machines. PERKINS Ground Thread Worms and Gears are produced by specially designed equipment. They are "mirror finished" by a special polishing operation and each gear is made to conform to PERKINS Super Standards of Quality.

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Write for prices.

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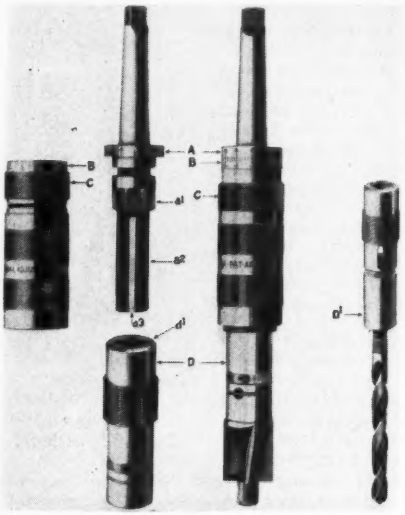
8400 South Chicago Ave. Chicago, Ill.

reamers, taps, drills, etc., has just been announced by the Eclipse Counterbore Company, 7410 St. Aubin Street, Detroit, Michigan. Instant micrometer adjustment for length (by hand) in conjunction with a constant positive lock in any position, are its principal features. Simplicity in its rugged construction is apparent, and perfect alignment is insured by generous bearing surfaces.

Referring to the illustrations, any change in length from 0.001 to 1¼ in. is instantly accomplished by raising the knurled lock sleeve (C) by hand and turning the adjusting sleeve (B), then lowering the lock sleeve. This is all



Eclipse Micro-Justable Holder.

that is required. A pawl located under this lock sleeve engages the serrations on the driving shank (a^1) and locks the holder against any possible accidental or forcible changes in adjustment. The square stem (a^2) provides a sturdy driving member in the broached hole (d^1) of the cutter holding member or socket (D), and the circular ground corners (a^3) provide perfect alignment in an accurately ground bearing in (D). Thrust is borne by the adjusting sleeve (B) against the thrust flange on driving shank (A).

Standard parts except the cutter socket are used throughout. The socket only shown as (D) and (D^1) is changed

NEW!

The Money-Saving Koebel Multi-point Diamond Dresser

This new dressing tool enables you to save money on your grinding wheels as well as cut down your truing tool costs. With two to five diamonds in contact with the wheel face, there is a very shallow penetration of the points which gives a quicker, smoother, straight-face dressing . . . with comparatively little wheel or diamond wear.

This accurate wheel truing assures improvement in finish of the work and increase in production . . . an accurately dressed wheel removes stock faster.

All KOEBEL diamond dressing tools give you large diamond efficiency with small diamond investment.

Write for full details of the Multi-point Dresser, which is especially effective for large wheels.

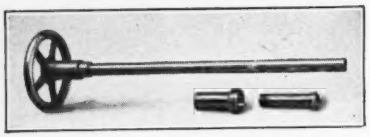
KOEBEL DIAMOND TOOL CO.

1200 OAKMAN BLVD.

DETROIT, MICHIGAN

when adapting the holder for use with different types of end cutting tool shanks. (D¹) shows the socket or lower end adapted for use with twist drills.

The unusual simplicity of the "Micro-Justable Length Holder," its compactness, rigidity in locked position, and the extreme ease with which it can be unlocked, adjusted and relocked instantly (by hand) without the need of any tools, make it highly desirable for multiple spindle operations involving accurate depths of counterbored, countersunk, drilled, reamed or tapped holes.



Collet Attachments for your lathes and millers

Write for Bulletin No. 100 A. M. — Rivett Draw-In Collets and Chucks. Also Price List and Dimension Sheet.

Rivett Lathe & Grinder Corp.

Brighton Dist., Boston, Mass., U. S. A.

work in the dark

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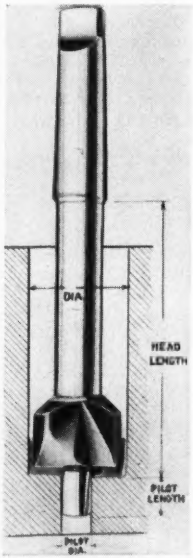
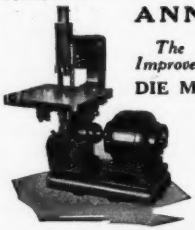
"O. K." Deep Counterbore

For deep counterboring operations, where the depth of the bore is as great or greater than the diameter of the cutter, The O. K. Tool Co., Inc., Shelton, Conn., has developed a two-blade counterbore as illustrated. It is stated that the tool is particularly adaptable for use where a considerable amount of stock has to be broken down or roughed out.



"O. K." Deep Counterbore.

The tool consists of a forged and heat treated alloy steel body, carrying two heavy duty adjustable O. K. cutter blades. The blades interlock with a pilot which guides the tool through the bore. The body is generously cut away to provide the maximum of chip clearance. Tools of sizes from 1½ in. to 6 in. are available with cutters of drop forged high speed steel, super-cobalt high speed steel, J. Stellite, or Cemented Carbide. Pilots of any desired diameters can be furnished, and the tool can be provided in left hand, or with special shanks or ground at special angles, and in odd sizes and lengths upon special order.



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Parker-Kalon Hardened Self-Tapping Cap Screws

To the line of self-tapping screws made by Parker-Kalon Corporation, 200 Varick Street, New York, N. Y., this company has added the Hardened Self - Tapping Cap Screw shown in the illustration. Like the other types of Parker-Kalon self - tapping screws, the cap screw forms its own thread as it is screwed in, thus eliminating the tapping. To use the screws, it is only necessary to punch or drill holes in the parts to be assembled, and thread the screws into the holes in the usual manner. The unique thread structure and special hardening treatment given to the screws make them capable of forming their own threads.

Parker-Kalon Self-Tapping Cap Screw

It is said that laboratory tests have shown that the screws stand up satisfactorily under tension stresses. They will also withstand great shear loads and will not loosen under severe vibration. Hex head hardened self-tapping cap screws can be used in sheet metal as light as 24 gauge (0.025 in.) up to 10 gauge (0.140 in.), in steel plates and structural shapes up to ½ in. thick, and in solid sections of many other materials, including brass, bronze, aluminum, die-castings, slate, transite board, ebony asbestos, and so on. Parker-Kalon hex head hardened self-tapping cap screws are made for stock in sizes from No. 6 x $\frac{3}{16}$ to $\frac{7}{16}$ x 2 inch.

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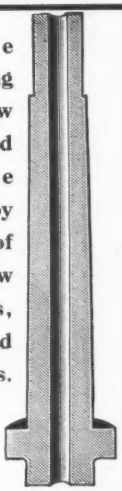

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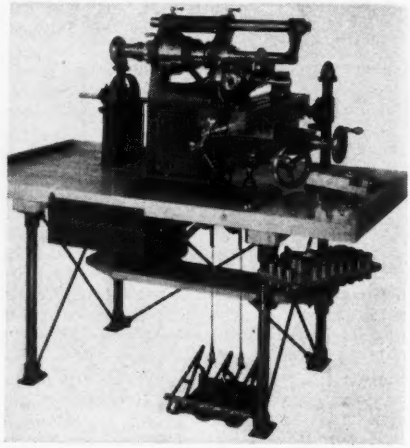
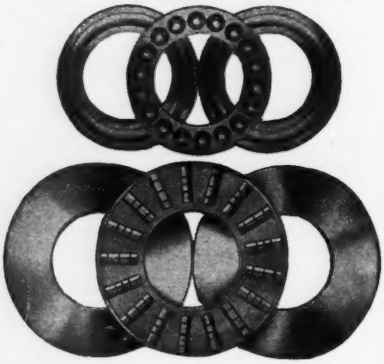
"Cataract" Six-Speed Motor Drive Unit Built By Hardinge Brothers, Inc.

The name of the manufacturer was inadvertently omitted from the description of the "Cataract" Six-Speed Motor Drive Unit which was published in the February issue of this magazine. The unit is made by Hardinge Brothers, Inc., Elmira, N. Y. The unit is shown here as applied to the Cataract No. 5 Bench Milling Machine. The drive, together with the four-step cone pulley, provides eight speeds forward and reverse.



"Cataract" Six-Speed Motor Drive Unit as applied to a bench milling machine.



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Manufacturers of metal products — whatever the nature — will find many items of interest in the "Udylite News," published monthly or thereabouts by Udylite Process Company, 3939 Bellevue Avenue, Detroit, Michigan. Each issue contains four pages of news concerning the manner in which various metal-manufacturing firms are making use of Udylite-Cadmium to prevent rust and deterioration and to enhance the appearance of everything from buttons to building domes. Manufacturers of metal products are invited to send their names to the above address to be placed on the "Udylite News" mailing list.

The most progressive manufacturer can give you the best service. The manufacturers represented in these pages are leaders in their industry; patronize them and mention MODERN MACHINE SHOP when doing so.

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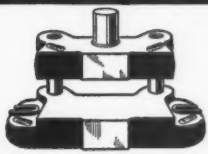

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Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Lubrication by Barrel-To-Bearing System: The most modern system of lubrication for machine tools is described in a folder that can be had by writing to Alemite Corporation, 2680 N. Crawford Ave., Chicago, Ill.

Chucks—Key and Keyless: Bulletin No. 120A, issued by T. R. Almond Mfg. Co., Ashburnham, Mass., describes and illustrates the line of key and keyless geared nut and ball bearing drill chucks made by this firm. Copy free upon request.

Cut Your Sawing Costs: "Lenox" hack saw blades and band saws are guaranteed to effect savings on your sawing operations. Write for information to American Saw & Mfg. Co., Springfield, Mass.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

"Atlas" Bench Lathe: A 9-in., screw cutting, self-contained, motor-driven bench lathe is now being built by Atlas Press Co., Kalamazoo, Mich. Write for circular.

Hold Odd-Shaped Pieces Securely: A vise in which odd-shaped work can be held securely without the need of special jaws or fixtures is described in a folder that has been issued by The Avey Drilling Machine Co., P. O. Box 487, Cincinnati, Ohio. Copy free upon request.

Drop Forged Steel Die Sets: The economy and other advantages of drop forged steel die sets, which are now being made by E. A. Baumbach Manfg. Co., 1806 South Kilbourn Avenue, Chicago, Ill., are explained in a folder that can be had by addressing this firm.

Don't waste time whittling out bushings and bearings that you can buy ready-made. Write The Bunting Brass & Bronze Co., Toledo, Ohio, for a catalog showing 500 sizes of finished bronze bushings that are carried in stock.

Gears Of All Kinds are described and illustrated, with specifications, in Catalog 80, which has been issued by the Chicago Gear Works, 769-773 West Jackson Blvd., Chicago, Ill.

Boring Tool With Micrometer Adjustment: A circular describing and illustrating the Palmgren Off-Set Boring Tool, which is adaptable for either tool or production work, can be had by addressing the Chicago Tool and Engineering Co., 84th St. and So. Chicago Ave., Chicago, Ill.

Diamond Boring: The newest methods of diamond boring all kinds of bearings, gears, motor frames, small bushings, and other similar work are outlined in a bulletin that also describes and illustrates three new diamond boring machines. A copy can be had by addressing the City Machine & Tool Works, 1521 East Third Street, Dayton, Ohio.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Steel Spacing Washers: Milling jobs can be set up quicker by using standard spacing washers, made by Detroit Stamping Co., 3445 West Fort Street, Detroit, Michigan. Write for information.

Interchangeable High Production Tools: Catalog No. 32, issued free by Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

"Speed" Spot Welders for welding metals from 0.0005 in. to 5/8 in. thick are described in a catalog that can be had by addressing Eisler Electric Corp., 761 South 13th Street, Newark, N. J.

The Red Liner is an automatic machine that inspects gears under conditions similar to those of actual operation, and charts errors on a 200-to-1 scale. Write Fellows Gear Shaper Company, Springfield, Vt., for booklet.

Performance Data On Swiss Jig Borers: This 36-page pamphlet shows various types of jobs from a power shovel turntable jig to a television disc, drilled and bored on Societe Genevoise High Speed Precision Borers, giving data as to size of holes, accuracy and time savings. Free upon request to The R. Y. Ferner Co., 1008 K Street, N. W., Washington, D. C.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Stampings of any kind or size can be obtained from Gerding Brothers, 5 East Third Street, Cincinnati, Ohio. Write for particulars.

Dynamic and Static Balance: Full information as to what static and dynamic balance means, the necessity for correct balance in rotating parts, methods of discovering and correcting unbalance, and the uses of balancing equipment can be had without charge by addressing Globe Tool & Engineering Co., Dayton, Ohio.

Ball and Roller Bearings, either journal or thrust, for all purposes and in all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Grinding, Polishing and Buffing Machines of the latest types are described and illustrated in a series of bulletins that have been issued by the Hammond Machinery Builders, Kalamazoo, Mich. Copies free upon request.

Drive Your Bench Lathe, Bench Miller, or other light machines with the "Cataract" Six-Speed Motor Drive Unit, made by Hardinge Brothers, Inc., Elmira, N. Y. Write for full information.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hjorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hjorth Lathe & Tool Company, 60 State Street, Boston, Mass. Copy free upon request.

Solve Your Tapping Problems with a Jarvis Tapper. Tapping devices for every type of job. Write The Charles L. Jarvis Co., Glidersleeve, Conn., for information and prices.

Dress Your Grinding Wheels Better, in less time, with less waste of wheel and diamond by using Koebel Multi-Point Diamond Dresser. Write Koebel Diamond Tool Co., 1200 Oakman Blvd., Detroit, Michigan, for details.

Threading Machinery: Complete catalogs of individual bulletins covering the pipe threading and cutting machines, bolt threading machines, or die heads made by Landis Machine Co., Waynesboro, Penna., may be had upon request from this firm. State size and type of machine or die head concerning which information is required.

Do you buy the same cutter over and over again? Every time you grind a cutter on an old-fashioned, time-wasting cutter grinding machine, you are paying for new cutters that you never get. Let the Landis

Tool Company, Waynesboro, Pa., tell you how to save this money. Write today.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Master Complete Power Drive: Booklet S210, issued by The Master Electric Company, 104 Davis Ave., Dayton, Ohio, describes and illustrates the Master Geared-Head Motor in service, with applications to all kinds of drives. Copy gratis.

"Hand-ee" Grinder: A grinder for use on dies, tools, and other fine work, made to fit the hand, weighing one pound, with plug to operate from light socket, is described in a folder that can be had by addressing the M. C. Tool Co., 120 South Aberdeen St., Chicago, Ill.

Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

"Commercial Lapping for Close Limits and High Production" is the title of a booklet that discusses hand and machine lapping, types of lapping tools and machines, workholders for machines, preparation of laps, preparation of work for lapping and other important points. A copy may be had by addressing Norton Company, Worcester, Mass.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

"Fastenings" is the title of a booklet, issued by the Parker-Kalon Corporation, 192-196 Varick Street, New York, N. Y., in which are included the results of surveys made in fourteen different plants as to the efficiency of fastening methods. Copy free upon request.

Good Gears of all kinds—spur, spiral, bevel, worm, hypoid—in fact, any kind or type of gear desired, large or small, machined to an excellent finish and the highest degree of accuracy, may be obtained from Perkins Machine & Gear Co., 151 Circuit Ave., Springfield, Mass. Write for estimates.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Control Your Air-Operated Equipment with speed, ease, and safety by using valves of the latest design. New catalog just out. Write the Ross Operating Valve Co., 6488 Epworth Blvd., Detroit, Mich.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Steel Stamps and Marking Dies: Full information as to steel stamps, steel roller dies, embossing dies, and embossing rolls made by the Schwerdtle Stamp Co., 10 Cannon Street, Bridgeport, Conn., can be had by writing this firm.

Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

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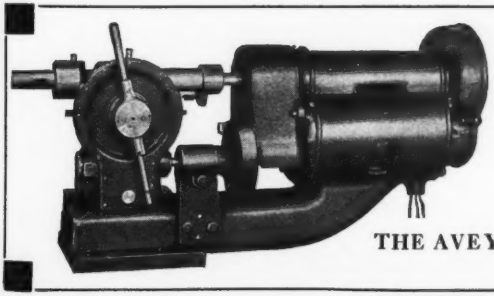

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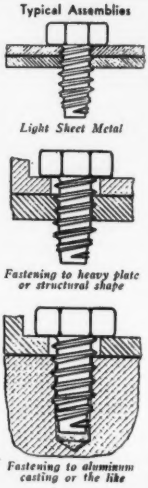

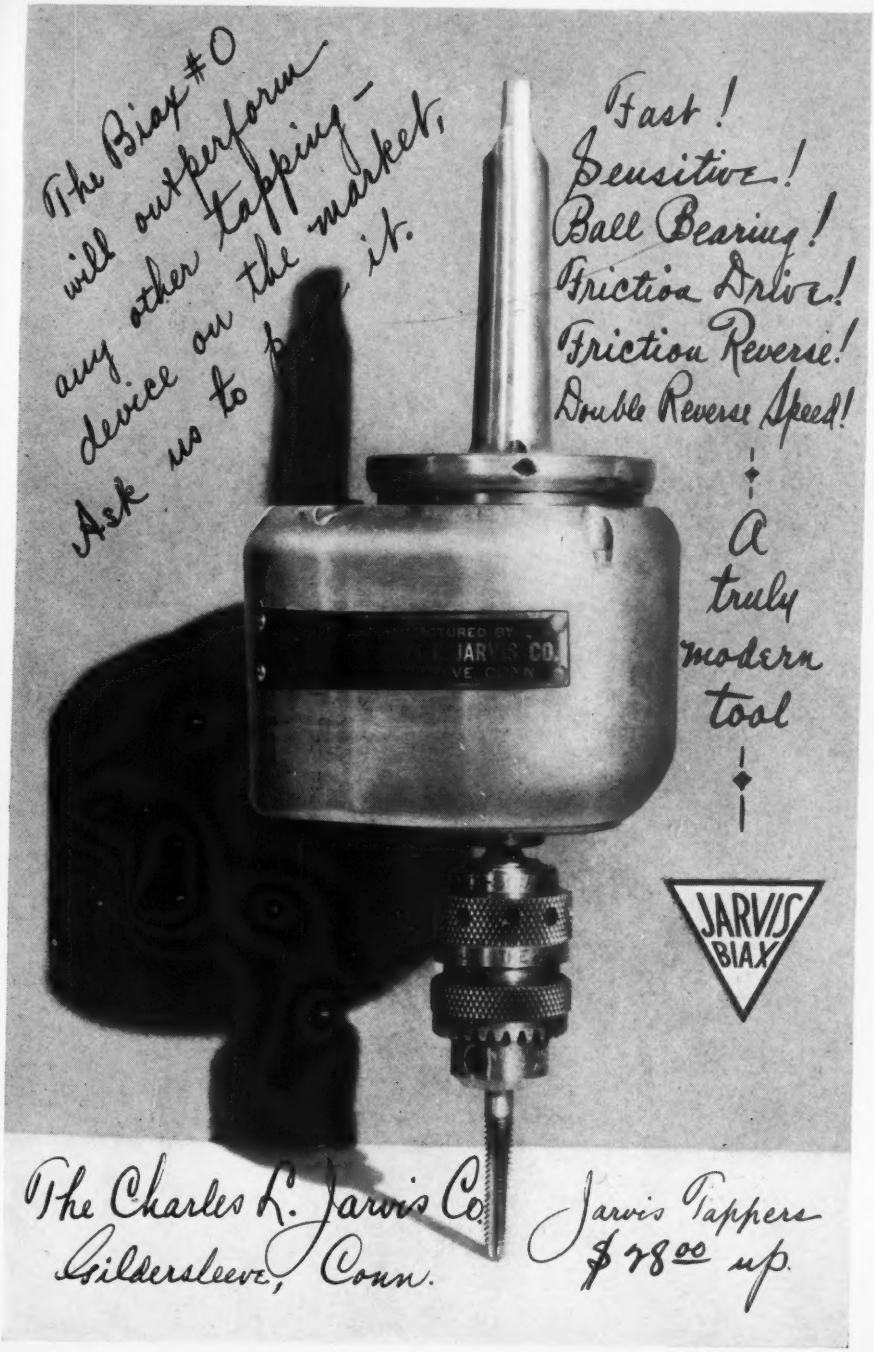
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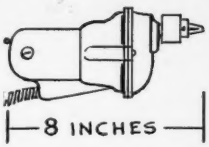

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